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FERNALD CITIZENS ADVISORY BOARD

FCAB UPDATE

Week of November 8, 1999

(Last update was dated October 18, 1999)

MEETING SCHEDULE

FERNALD SILOS WORKSHOP — **Alpha Building**
Wednesday, November 17, 1999, 6:30 p.m.

OHIO EPA PUBLIC AVAILABILITY SESSION ON SILOS — **Venice Presbyterian Church**
Wednesday, December 1, 1999, 6:30 p.m.

REMEDIATION COMMITTEE — **Large Laboratory Conference Room**
(NOTE: This meeting is to finalize the FCAB silos decision, all CAB members are to attend)
Monday, December 6, 1999, 6:00 p.m.

Please if you will not be able to attend any meeting, please call the FCAB office and let us know.: 648-6478

ATTACHMENTS

- 2000 FCAB Calendar
- Critical Analysis Team Report on the Draft Revised Feasibility Study
- Consensus Review of the DOE Independent Review Team
- News Clippings

NEWS and ANNOUNCEMENTS

- There is no stewardship committee meeting in December
- The FCAB's address has changed from the P.O. Box in Ross to Fluor Daniel Fernald, PO Box 538704, MS 76, Cincinnati, OH 45253-8704.

FOR FURTHER INFORMATION

Please contact Doug Sarno, Phoenix Environmental
Phone: 513-648-6478 or 703-971-0058 Fax: 513-648-3629 or 703-971-0006
E-Mail: PhnxEnvir@aol.com or DJSarno@aol.com

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FERNALD CITIZENS ADVISORY BOARD

2000 CALENDAR
as of 11/5/99

JANUARY

11	DOE Monthly Progress Briefing
12	Stewardship Committee, 6:30 pm
13	Remediation Committee, 6:30 pm
15	Full CAB Meeting, 8:30 am

FEBRUARY

8	DOE Monthly Progress Briefing
9	Stewardship Committee, 6:30 pm
10	Remediation Committee, 6:30 pm

MARCH

14	DOE Monthly Progress Briefing
15	Stewardship Committee, 6:30 pm
16	Remediation Committee, 6:30 pm
18	Full CAB Meeting, 8:30 am

APRIL

11	DOE Monthly Progress Briefing
12	Stewardship Committee, 6:30 pm
13	Remediation Committee, 6:30 pm

MAY

9	DOE Monthly Progress Briefing
10	Stewardship Committee, 6:30 pm
11	Remediation Committee, 6:30 pm
13	Full CAB Meeting, 8:30 am

JUNE

13	DOE Monthly Progress Briefing
14	Stewardship Committee, 6:30 pm
15	Remediation Committee, 6:30 pm

JULY

11	DOE Monthly Progress Briefing
12	Stewardship Committee, 6:30 pm
13	Remediation Committee, 6:30 pm
15	Full CAB Meeting, 8:30 am

AUGUST No meetings

SEPTEMBER

12	DOE Monthly Progress Briefing
13	Stewardship Committee, 6:30 pm
14	Remediation Committee, 6:30 pm
16	Full CAB Meeting, 8:30 am

OCTOBER

10	DOE Monthly Progress Briefing
11	Stewardship Committee, 6:30 pm
12	Remediation Committee, 6:30 pm

NOVEMBER

14	DOE Monthly Progress Briefing
15	Stewardship Committee, 6:30 pm
16	Remediation Committee, 6:30 pm
18	Full CAB Meeting, 8:30 am

DECEMBER Committee meetings as needed

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2621 Sano

United States Government Department of Energy

memorandum

Oak Ridge Operations

DATE: October 12, 1999

REPLY TO ATTN OF: Stephen H. McCracken, EM-95

SUBJECT: CONSENSUS REVIEW OF THE DOE INDEPENDENT REVIEW TEAM

TO: Nina Akgunduz, Fernald Area Office

Please find attached the consensus review of the DOE Independent Review Team. The Feasibility Study documents have been significantly improved since our initial review and we look forward to this important work moving forward. Flour Daniel Fernald and the Critical Analysis Team should be commended for their efforts.

Susan Aleman (DOE/SRS)	Date
Stephen Folga (ANL)	Date
Dirk Gombert (INEEL)	Date
David Rast (DOE/Pantex)	Date
S H McCracken Stephen McCracken (DOE/WSSRAP)	10/13/99 Date

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SUMMARY

In early 1999 a DOE Independent Review Team (herein referred to as the Team or the Review Team) was formed to review the Operable Unit 4 (OU4) Draft Feasibility Study (FS). Since the initial review in February '99 the Team has continued to review and provide input to the study with the primary emphasis being soundness and reasonableness of technical basis, assumptions, analysis, evaluations, and cost estimates. Draft FS documents and cost estimates prepared by Flour Daniel (FDF) as well as Proof of Principle (POP) tests prepared by four technology vendors were reviewed independently by Team members with support from FDF. The Team met during the week of October 5,1999 to conduct a final review, achieve consensus on issues and coordinate with the Critical Analysis Team (CAT).

During the October 5 review the Team reached the following conclusions:

- The FS documentation generally presents a fair and balanced comparison of the treatment alternatives.
- The cost estimates are generally well done and credible (note: this is with the understanding that the comments attached to this report will be incorporated).
- The Comparative Summary Analysis and Implementability Summary Table (ref: Figures 4.1-1 and 4.2-1) generally provide an accurate comparison of the two classes of technologies (i.e.: vitrification vs chemical stabilization) however additional explanatory/factual statements should be considered. This would be useful to give the reader an understanding of the rationale that supports the comparisons. These statements would also provide the reader an understanding of differences between technologies in the same class.
- The Review Team agrees that "Implementability" is the single most important differentiator between technologies. However, the cost estimates would better reflect the differences if the impacts of potential technology failures and resultant maintenance resources and schedule delays were estimated and included in the life-cycle project costs.

SUPPORTING DISCUSSION

I. IMPLEMENTABILITY

Analysis of the CERCLA criteria for evaluation of technology options shows that both classes of technology (vitrification and chemical stabilization) should be able to meet the treatment goals. However, implementation may be variable depending on the technology selected. This is clear from the current version of the FS, and it is the consensus of the Review Team that the evaluation presented is generally accurate and fairly presented. The differences in implementability could probably be reflected more clearly in the estimates of cost and schedule if more, comparable operating data were available, but this is not the case.

It is the opinion of the Review Team that Figures 4.1-1, Comparative Analysis Summary and particularly Figure 4.2-1, Implementability Summary Table, provide the reader an important snapshot representation of the comparison of classes of technologies. One weakness of the charts is that they do not differentiate technologies in the same class. For instance, Scaleup, Innovation and Ease of Acceleration favor Non-Joule Heated Vitrification over Joule - Heated and the reader can only derive this from the extensive text of the documents. Scaleup and Ease of Acceleration (Schedule Recovery) are probably self explanatory, but this conclusion on Innovation is based on the fact that a joule-heated melter of the size and capability proposed would be a first-of-its-kind, novel design that would require significantly greater check-out than a standard design prior to operation. It is recommended that factual statements, which support the conclusions of each Item, should accompany these charts. These statements could also serve to differentiate between "same class" technologies. The notes below provide the basis for the teams' review and agreement with Figure 4.2-1. In general the notes were derived from the reports however some notes are the opinion of the Team. It is the Team position that Administrative Feasibility favors Chemical Stabilization for the reasons stated below.

NOTES to IMPLEMENTABILITY SUMMARY TABLE

Scaleup – Favors *Non-Joule Vitrification* and *Chemical Stabilization*

- Cyclone vitrification - POP demonstration at full scale (+)
- Joule-heated vitrification - 45-to-1 scale-up from POP test (-),
- Cyclone and Joule-heated - new design (-), one-of-a-kind (-)
- Chemical stabilization - commercial operations at scale (+), been demonstrated with radioactive materials at required throughput (+), standard equipment for full-scale (+)

Commercial Demonstration – Favors *Chemical Stabilization*

- Cyclone vitrification – full-scale operation on pot liners (+), not radioactive operations (-)

- Joule-heated vitrification – full-scale operation on standard glasses (+), radioactive operations (+), but small-scale throughput (-), problematic startup (-), and few operating facilities (-)
- Chemical stabilization - radioactive operations (+), demonstrated at scale (+), many operating facilities (+), but some recipe failures (-)

Operability

Ease of Operation – Favors *Chemical Stabilization*

- Vitrification - thermal operations (-), more complex offgas treatment (-), shorter response time before potential failure (-), specialized knowledge to maintain normal operations (-), vitrification operations are typically remote (+)
- Chemical stabilization – experience with typical operation has been manual and will require innovation to make remote (-)

Reliability – Favors *Chemical Stabilization*

- Chemical stabilization - core technology redundancy (+), standard equipment (+)
- Vitrification – more complex offgas treatment with many components in series (-)

Maintainability – Favors *Chemical Stabilization*

- Vitrification - thermal operations (-), joule-heated potentially requires electrode feed (-), refractory and refractory-lined equipment replacement required under remote conditions (-)
- Chemical stabilization - numerous mechanical components (-), but standard equipment (+)

Complexity – Favors *Chemical Stabilization*

- Vitrification - more complex offgas treatment (-), thermal operations (-), greater unique skill required to ensure normal operations (-)
- Chemical stabilization - standard equipment (+), many mechanical components (-), change-out of core technology quicker and probably simpler (+)

Ease of Acceleration (schedule recovery) – Favors *Chemical Stabilization*

- Cyclone vitrification - potential for schedule recovery with addition of off-gas treatment capacity (+)
- Joule-heated vitrification - limited potential requiring greater scale-up (-)
- Chemical stabilization - potential for schedule recovery as proposed (+)

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- Joule-heated vitrification – full-scale operation on standard glasses (+), radioactive operations (+), but small-scale throughput (-), problematic startup (-), and few operating facilities (-)
- Chemical stabilization - radioactive operations (+), demonstrated at scale (+), many operating facilities (+), but some recipe failures (-)

Operability

Ease of Operation – Favors *Chemical Stabilization*

- Vitrification - thermal operations (-), more complex offgas treatment (-), shorter response time before potential failure (-), specialized knowledge to maintain normal operations (-), vitrification operations are typically remote (+)
- Chemical stabilization – experience with typical operation has been manual and will require innovation to make remote (-)

Reliability – Favors *Chemical Stabilization*

- Chemical stabilization - core technology redundancy (+), standard equipment (+)
- Vitrification – more complex offgas treatment with many components in series (-)

Maintainability – Favors *Chemical Stabilization*

- Vitrification - thermal operations (-), joule-heated potentially requires electrode feed (-), refractory and refractory-lined equipment replacement required under remote conditions (-)
- Chemical stabilization - numerous mechanical components (-), but standard equipment (+)

Complexity – Favors *Chemical Stabilization*

- Vitrification - more complex offgas treatment (-), thermal operations (-), greater unique skill required to ensure normal operations (-)
- Chemical stabilization - standard equipment (+), many mechanical components (-), change-out of core technology quicker and potentially less challenging (+)

Ease of Acceleration (schedule recovery) – Favors *Chemical Stabilization*

- Cyclone vitrification - potential for schedule recovery with addition of off-gas treatment capacity (+)
- Joule-heated vitrification - limited potential requiring greater scale-up (-)
- Chemical stabilization - potential for schedule recovery as proposed (+)

Robustness – Neutral, both technologies challenged

- Vitrification - normal operations within tight operating envelope (-)
- Chemical stabilization – normal operations within tight operating envelope (-)

<u>Constructability</u> – Favors *Chemical Stabilization*

- Vitrification - more complex offgas treatment system (-), refractory lining (-)
- Chemical Stabilization – installation of standard componente (+)

<u>Administrative Feasibility</u> – Favors *Chemical Stabilization*

- Vitrification - longer startup times for operator training and system check-out (-), more complex (and potentially more difficult) ORR due to thermal operations (-), additional complexity due to application of substantive requirements for offgas treatment (-)

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II. COST

The four cost estimates for the OU4 Draft FS were reviewed for consistency, technical approach, and overall validity. Appendix C contains a synopsis of these four cost estimates. A number of comments have been generated during a review of the preliminary cost estimates, which are provided as an attachment. Also included with these comments are FDF's preliminary responses to these comments.

In general, the Review Team is satisfied with the contents of Appendix C. The majority of the outstanding cost issues has been addressed or is in the process of being addressed. It is important that the cost estimates reflect the differentiation that is exhibited in Figure 4.2-1, Implementability Summary Table.

The issues identified as important in the recent cost review are:

1. Risk budget (also known as uncertainty analysis or contingency);
2. Secondary waste generation, packaging, and shipping;
3. Decontamination and demolition (D&D) waste.

The following provides a brief synopsis of these issues.

Risk Budget

Risk budget is defined as the potential growth in cost due to unforeseen events such as inclement weather, unexpected cost escalation, etc. The approach taken by FDF to estimate the risk budget for the four alternatives appear valid and agrees with standard cost estimating practices.

For the operation and maintenance (O&M) phase, the risk budget for the four alternatives ranges from 14% to 17% of the total O&M cost. However, this fairly tight range in risk budget for the O&M phase between the four alternatives is not in agreement with the conclusions shown in Figure 4.2-1 (Implementability Summary Table), which indicates that *Chemical Stabilization* is judged to be more implementable than *Vitrification*. The Review Team has concluded that the budget estimate is probably in error rather than the verbal description of implementation risk.

Therefore it is the recommendation of the Review Team that the FDF cost estimating team compare the individual cost factors assumed during the estimation of the risk budget with the implementability factors in Table 4.2-1.

Secondary Waste Generation, Packaging, And Shipping

One potential cost differentiator between the various alternatives is the amount of secondary waste generated during operation and maintenance. The unique characteristics of the four alternatives may result in secondary waste streams with differing waste characteristics. One example waste for vitrification is the refractory material protecting the main processing unit.

which is expected to be replaced on a routine basis during operations. There does not appear to be a comparable waste stream generated by the *Chemical Stabilization* alternatives.

Appendix C does not provide sufficient detail on the secondary waste expected to be generated as a result of O&M activities, their generation rate, the characteristics of these wastes (whether low-level radioactive waste, mixed waste, etc.), the type of treatment (whether packaging for off-site disposal, treatment at the AWWT, etc.), the number of containers, the number of off-site shipments to NTS (as appropriate).

Therefore it is the recommendation of the Review Team that the above information be included in Appendix C of the OU4 FS.

Decontamination and Demolition (D&D) Waste

Another potential cost differentiator between the various alternatives is the amount of waste generated as a result of decontamination and demolition (D&D) of the immobilization facility and supporting structures.

Appendix C does not provide sufficient detail on the waste expected to be generated as a result of D&D activities, their generation rate (bulked and unbulked), the characteristics of these wastes (whether low-level radioactive waste, mixed waste, etc.), the type of treatment (whether packaging for off-site disposal, etc.), the number of containers, the number of off-site shipments to NTS.

Therefore it is the recommendation of the Review Team that the above information be included in Appendix C of the OU4 FS.

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2621 ~~Steve B.~~ Saiko

Critical Analysis Team Report on the Draft Revised Feasibility Study for Remediation of Silos 1 and 2 Waste.

CAT Report 11

21 October 1999

The Critical Analysis Team (CAT) has completed its review of the Draft Revised Feasibility Study (FS) for remediation of Silos 1 and 2 wastes. The CAT has reviewed multiple revisions of the FS over a several month period to ensure that, (1) the presentation is based on facts, not opinions; (2) the document contains sound cost, schedule and technical information; and, (3) the document text is appropriately supported by the data.

This CAT report is organized as follows: (1) the CAT's general feedback on the document; (2) a table (Attachment 1) comparing issues in concerning each technology as viewed by the CAT; and (3) Attachment 2 is the CAT's specific comments on the document.

The Feasibility Study is now ready for release. While the CAT comments on this report raise a number of concerns, resolution of the concerns would not likely fundamentally alter the document or its analysis. It is important that the Silos 1 and 2 project move on as quickly as possible, and continuing to wordsmith the FS is counter to "getting on with the project."

FDF involved the CAT early in the document development process. This allowed the CAT a better understanding of the document and has made it easier for FDF to incorporate CAT comments into the document. FDF should be commended for its efforts in conducting an open document development process and working to resolve and incorporate comments.

The document development process must continue to be open. To this end, DOE should release the document to all interested parties and begin the public review as soon as possible. The ROD Amendment process is lengthy and, while the CAT recognizes the regulatory basis for this process, the CAT urges DOE to complete the ROD process as soon as possible. Engaging the public as a partner in decision-making early increases the prospect for early completion of the ROD Amendment, solidifying public support and getting on with the project.

While the CAT has several outstanding concerns, the document presentation is relatively fair and balanced. The document provides a suitable basis for making a decision on treatment of the Silos 1 and 2 wastes. However, the data presented in the document does not overwhelmingly support the selection of any of the alternatives. In the case of most of the decision-making criteria, there is no discriminating difference among the technologies.

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As a result of the parity among technologies, the decision to favor one technology over another is largely a personal value judgment. The relatively subjective consideration of "implementability"—which technology is more likely to be successful—is very important to this particular decision. In addition, individual values play a role in judging the technologies. For example, if an individual feels that waste volume or processing temperature are the most important considerations, the individual's technology preference would reflect that belief.

The CAT emphasizes that the technology decision is *not* the most important factor in determining success of the Silos 1 and 2 remediation project. Many of DOE's failures of both chemical stabilization and vitrification have been the result of poor designs or management problems. Similar risks exist for this project. The following four factors, independent of the technology selected, will weigh heaviest on the project's relative success or failure:

- **Capability of the selected vendor.** While the POP test vendors were intended to be representative of each technology, each vendor's technology and/or approach had several unique characteristics. Some vendors, both vitrification and chemical stabilization, will be more capable than others. It is critical that the procurement process select a technically capable vendor that has a proven ability to perform.
- **DOE and FDF management of the project.** Many failed DOE projects (including the Vitrification Pilot Plant) have suffered from poor management. None of the technologies are sufficiently simple to build and operate themselves—success will only come from knowledgeable, experienced, involved and committed management.
- **Success or failure of Silo 3 and Accelerated Waste Retrieval (AWR) projects.** Silos 1 and 2 remediation relies heavily on the success of both Silo 3 and AWR. AWR in particular is necessary to provide feed for the Silos 1 and 2 treatment facility. Almost as important, the successful completion of all three silos projects is dependent upon the smooth flow and transition of capital, resources, and personnel throughout the project. If Silo 3 and/or AWR delay the current schedule or experience cost growth, Silos 1 and 2 remediation could be in jeopardy.
- **Labor force.** Fixed-price contracting in the context of Fernald's site labor agreement will be difficult. This creates a situation where personnel are working for a contractor to whom they are not directly responsible. Regardless of the performance of workers, contractors may have an incentive for claims purposes to shift blame for problems to the workforce.

Technical Challenges

In its involvement with the POP tests and the development of supporting engineering data, the CAT believes the following:

- All alternatives can be implemented.
- All technologies have relatively equal levels of technical risk making any difference among them minimal.
- No alternative is the clear "winner" or "loser" – each has strengths and weaknesses.
- No alternative requires extensive or sophisticated development.
- There are no unique materials of construction in the application of the technologies.
- All technologies require equipment modifications and unique facility designs to facilitate remote operations and protect personnel.
- All major process equipment is commercially available, although a few items do require custom design and fabrication.

As the text of the FS shows, all of the technologies would be technically challenging to implement. However, the technical risks are different for each technology. Following are the most significant risks the CAT has identified for each technology:

- **Joule heated vitrification (VIT-1):** The two greatest technical challenges for this technology are (1) the scale-up to a melter several times larger than any operating on similar wastes; and (2) the ability of the joule heated melter to avoid sulfate problems similar to those experienced in the Fernald Vitrification Pilot Plant.
- **Combustion vitrification (VIT-2):** The two greatest technical challenges for this technology are (1) treating the large volumes of melter off-gas; and (2) drying the waste feed prior to its introduction into the melter.
- **Chemical stabilization (CHEM-1):** The three greatest technical challenges for this technology are (1) the ability to remotely operate the mechanical stabilization system; (2) obtaining adequate product waste loading to minimize transportation and disposal costs; and (3) the ability to make acceptable product while minimizing recycle.
- **Chemical stabilization (CHEM-2):** The two greatest technical challenges for this technology are (1) the ability to operate the mechanical stabilization system remotely; and (2) obtaining adequate waste loading to minimize transportation and disposal costs.

Recommendations

- **Recommendation 11-1:** FDF and DOE should work with EPA to expedite the schedule for completion of the Record of Decision. The CAT sees no reason why completion of the ROD should take until the Spring of 2001. Public review of the document and public involvement activities should begin as soon as possible.

- **Recommendation 11-2:** Were the chosen technology to fail, the Record of Decision should include sufficient flexibility to allow for an "alternate path" consisting of another technology family to allow seamless transition and avoid years of regulatory documentation..

➢ **Recommendation 11-3:** Fluor should develop a in-house team of experts that can quickly and accurately respond to public questions about the Feasibility Study. DOE should utilize this team to support and participate in public meetings, discussions and workshop presentations.

ATTACHMENT 1: TABLE OF WASTE TREATMENT AND DISPOSAL ISSUES

In an attempt to clearly and succinctly describe the major treatment and disposal issues associated with each technology, and assist the reviewer in understanding these issues, the CAT has developed the following table with the pros and cons of the technologies. The CAT does not offer this table as comprehensive, but rather as an attempt to allow the reader to assess each technology based on qualitative facts.FDF is free to use this list if they believe it could prove useful.

VIT-1 Joule heated vitrification(Envitco)	VIT-2 vitrification-other (VORTEC)	CHEM-1 chemical stabilization-cement based (IT)	CHEM-2 chemical stabilization-other (CNS)
Scale-up presents significant challenges; first of a kind joule heated melter for this type of waste at this scale. This amounts to a demonstration facility.	The POP test for vitrification-other was demonstrated at a scale sufficient to meet project objectives. Higher capacities may be feasible.	Scale-up for chemical stabilization has been demonstrated on industrial materials. While it has not been demonstrated with this waste, scale-up should not present significant challenges.	Scale-up for chemical stabilization has been demonstrated on industrial materials. While it has not been demonstrated with this waste, scale-up should not present significant challenges.
Presence of sulfate in waste feed could cause problems similar to those experienced in the Vitrification Pilot Plant.	Presence of sulfate is a concern, however less so than with VIT-1.	Presence of sulfate should present no process problems for chemical stabilization.	Presence of sulfate should present no process problems for chemical stabilization.
Cost and schedule are not sensitive to minor waste loading changes.	Cost and schedule are not sensitive to minor waste loading changes.	Cost and schedule for are very sensitive to changes in waste loading.	Cost and schedule for are very sensitive to changes in waste loading.
Within the accuracy of the estimate, the costs are basically equal.	Within the accuracy of the estimate, the costs are basically equal.	Within the accuracy of the estimate, the costs are basically equal.	Within the accuracy of the estimate, the costs are basically equal.

Vitrification joule heated	Vitrification-other	Chemical stabilization-cement	Chemical stabilization-other
Requires operators to make process control adjustments while the process continues operation.	Requires operators to make process control adjustments while the process continues operation.	The batch process allows some time for process adjustments. However, adjustments may not be possible until a significant amount of unacceptable waste product is created.	The batch process allows some time for process adjustments. However, adjustments may not be possible until a significant amount of unacceptable waste product is created.
Chemically and physically binds the waste.	Chemically and physically binds the waste.	Physically binds the waste.	Chemically and physically binds the waste.
The melter is a single piece of specialized equipment. Problems with the melter could lead to long delays in restarting the facility.	The melter is a single piece of specialized equipment. Problems with the melter could lead to long delays in restarting the facility.	While mixers may fail, they are more readily available and easier to replace than melters.	While mixers may fail, they are more readily available and easier replace than melters.
Operates at high temperatures (approximately 1150 C).	Operates at high temperatures (approximately 1500 C).	Operates at low (ambient) temperatures.	Operates at low (ambient) temperatures.
Produces 2,398 containers. Number of containers is not sensitive to waste loading.	Produces 2,162 containers. Number of containers is not sensitive to waste loading.	Produces 6,078 containers. Number of containers is sensitive to waste loading.	Produces 6,106 containers. Number of containers is sensitive to waste loading (e.g. if waste loading is 18% instead of 24%, number of containers increases to 7,877.
Cannot quickly stop process operations in an emergency situation. When not processing, melter must maintain contents as molten glass.	Can stop process operations more quickly than joule heated vitrification because the waste does not remain in the melter for a long period of time.	Is forgiving in the ability to quickly stop process operations. However, emergency stops could lead to large volumes of secondary waste that must be recycled.	Is forgiving in the ability to quickly stop process operations. However, emergency stops could lead to large volumes of secondary waste that must be recycled.

Vitrification Joule heated	Vitrification-other	Chemical stabilization-cement	Chemical stabilization-other
Glass is generally viewed as a more stable waste form. In the melting process, radon is released to the off-gas, and radon generation in the waste form is extremely low.	Glass is generally viewed as a more stable waste form. In the melting process, radon is released to the off-gas, and radon generation in the waste form is extremely low.	Radon is an issue throughout treatment, curing, and storage of the stabilized waste.	Radon is an issue throughout treatment, curing, and storage of the stabilized waste.
Some potential for generating secondary waste streams.	Significant potential for generating solid and liquid secondary waste streams.	Significant potential for generating secondary liquid waste, particularly during shutdown (flush equipment).	Significant potential for generating secondary liquid waste, particularly during shutdown (flush equipment).
Relatively simple to automate (although remote electrode adjustment and replacement could prove difficult). Adjusting the process "on the fly" will require continuous attention. Complex off-gas system with standard equipment, but many simultaneous unit operations.	Relatively simple to automate. Adjusting process "on the fly" will require continuous attention. Complex off-gas system with standard equipment but requires several integrated unit operations.	Many mechanical parts that could prove difficult to automate for reliable, trouble-free operation. More complex storage scenario due to continuous radon generation and number of containers.	Many mechanical parts that could prove difficult to automate for reliable, trouble-free operations (particularly the waste container fill-head). More complex storage scenario due to continuous radon generation and number of containers.
Insufficient information to determine sampling capability or difficulties. This area should not be ignored.	A cullet waste form that should result in a simpler product sampling system. Insufficient information to determine sampling capability or difficulties. This area should not be ignored.	Insufficient information to determine sampling capability or difficulties. This area should not be ignored.	Insufficient information to determine sampling capability or difficulties. This area should not be ignored.

Vitrification joule heated	Vitrification-other	Chemical stabilization-cement	Chemical stabilization-other
Because of scale-up issues, little potential for acceleration	Potential for acceleration which would impact interim storage capacity and the RCS system. Shipping rate (which is subject to public acceptance) will affect schedule acceleration.	Potential for acceleration which would impact interim storage capacity. Shipping rate (which is subject to public acceptance) will affect schedule acceleration.	Potential for acceleration which would impact interim storage capacity. Shipping rate (which is subject to public acceptance) will affect schedule acceleration.

ATTACHMENT 2: CAT COMMENTS ON THE DRAFT FS FOR REMEDIATION OF SILOS 1 AND 2

The CAT has the following specific comments on the latest version of the FS. These comments are provided for FDF's information and consideration. As the comments show, the CAT has many concerns with the FS. However, the CAT stresses that, were these concerns all resolved and incorporated into the document, they would likely not alter the document or its analysis. In short, a document of this size and scope could be wordsmithed for a very long time and still contain deficiencies. The CAT's desire is that the project move forward and these comments not impede that process.

For comparative purposes, the document inappropriately combines the two chemical stabilization technologies and the two vitrification technologies. Page 4-4, lines 13-14 state, "No differences were identified in the detailed analysis of alternatives that provide a compelling reason to select one process option over the other in either treatment technology alternative." While the CAT agrees that it would not be wise to select a very specific technology in the ROD, for the purposes of analysis there are significant differences between the individual processes within a technology family. Lumping the two processes into a technology family tends to blur important information, and characteristics of any process could be inappropriately applied to another process.

Data and text supporting the assumptions in the document must be available and clearly identifiable to the reader. FDF must document telecons and meetings, etc. which impact decisions. Also, processes must be developed that clearly support assumptions/decisions in the document. An undocumented meeting that results in important decisions is insufficient. An example of this is found on page ES-5 where the FS states that information was obtained from "current data bases and vendor interviews." The CAT was unable to find a single reference to a recorded data base search or vendor interview.

Another example is the assumptions for startup of the facilities (Tables 3.2-1, 3.3-1, 3.4-1 and 3.5-1). The POP test assumptions required vendors to design facilities that could complete waste treatment in three years. The Draft FS includes a 6 month startup period for both vitrification and chemical stabilization. In addition, a six month cold testing period has been added to vitrification. This extends the operational period for vitrification from 3 years to 3.5 years (20 more days operability testing and 80 days proof of principle testing for vitrification). Startup of the technologies is likely to be similar. The CAT was unable to identify why and through what process FDF decided to include an additional 6 months for vitrification.

The FS seems to largely ignore the issue of remote operations and maintenance for all four technologies. This oversight is most glaring in the chemical stabilization portions of the report. No mention is made of the challenges to design, build and test materials handling equipment for remote operation. The text gives the impression that these systems are commercially available—they aren't. A similar problem potentially exists with VIT-1 in the installation and adjustment of electrodes.

The FS cost estimate appears well developed, organized, and sufficiently detailed. FDF should take credit for this good work. The cost estimate appears equivalent to an advanced conceptual estimate. It is supported by considerable detail, including equipment data sheets and a detailed schedule with milestones. In addition, the basis for each cost element is traceable to the source of the cost. The CAT commends FDF for this work. In addition, the CAT notes that the cost estimate appears to have been the responsibility of one individual – as opposed to multiple authors for the text – resulting in a more coherent presentation.

One cost estimate deficiency is that the estimate doesn't appear to adequately take into account a significant chemical stabilization assumption. The current chemical stabilization scenario assumes starting up and shutting down the system 780 times during the project life (5x52x3=780 events). This number of startups and shutdowns amounts to abuse of the system. Hanford data clearly indicates system availability is directly dependent upon its operating history. That is, frequent starts and stops lead to failure and shorten system life. Further, the logistical challenges in starting and stopping operation every day are daunting – procedures, checklists, planning meetings, safety meetings.

The CHEM-1 operating scenario of starting and stopping the process each day will probably require a system flush following each shutdown. That portion of the process system prior to additive addition and mixing can be flushed to the feed tank. However that portion of the process following additive addition and mixing must be flushed to a separate holding tank and treated through some other method. None of this has been discussed or costed in the FS.

The cost estimate does not include any penalty or risk budget associated with this activity. A risk budget should be allocated based on this assumption. This number of startups and shutdowns is more indicative of a laboratory environment rather than a production process.

FDF needs to develop a group of experts that can quickly and accurately respond to questions in a public forum. Because the FS was written by multiple authors and is a large, complex document, FDF needs to ensure it has the capability to accurately respond to public inquiry. A public perception that FDF doesn't understand its own document would prove unacceptable.

Because of the linkage of the FS and PP, these documents should be reviewed simultaneously. The CAT is eager to review the Proposed Plan in the near future. It is important that the proposed plan contain a decision that is supported by the FS and, at this point, the CAT is unable to make this determination.

Assumptions about the Advanced Waste Water Treatment plant (AWWT) may be inaccurate or incomplete. The CAT identified several instances in both the POP designs and the FS where assumptions about the availability, capacity and capability of the AWWT may be incorrect. For example, in certain instances the subcontractor may be planning on sending more wastewater to the AWWT than would be allowed. Also, incidents such as heavy rainfall will render the AWWT unavailable for the Silo 1 and 2 Project (because of treatment capacity and priority). All processes have the potential for sending significant volumes of liquid waste to AWWT. Because the AWWT only treats solids and uranium, blending will be used with the Silos 1 and 2 wastewater to meet discharge requirements. The project could easily overburden the AWWT both in terms of contaminants and volume.

Page ES-17, Lines 11-15: This section states that chemical stabilization is 10% less costly than vitrification. It should also be stated that the cost estimate is a +50/-30% estimate, making the costs essentially equal.

Page ES-13, Lines 15-17: This page discusses vitrification in two separate bullets (one for joule heated vitrification and one for vitrification-other). However, Chemical stabilization is represented by only one bullet. There is a significant difference between the two chemical stabilization technologies and discussing them as two separate bullets should reflect this.

P. 3-31, line 19: This line states that remote operations concerns are "consistent across the four technologies..." The CAT feels the remote application will be more difficult for chemical stabilization than for vitrification. This belief is due to the multiple mechanical operations associated with chemical stabilization.

P. 3-47, 05: Is there any reason to believe the silo solid secondary waste will not meet the NTS WAC? If so, actions should be taken to evaluate the risk and identify alternative disposal locations.

P. 3-58, Line 13: If the shredded steel is returned as feed to the melter, does this present any process problems? That is, small steel particles in the feed stream or in the glass.

P. 3-70, Line 14: States that the Silo material has been "thoroughly characterized." The CAT sees this as an overstatement. Suggest dropping the word "thoroughly."

P. 3-70, Line 16: How is a recycling requirement going to be enforced upon a subcontractor? Typically, recycling is more costly than using new materials, and voluntary compliance with this requirement probably won't happen. In addition, how will compliance be measured? Will goals be set and penalties imposed for exceeding goals?

P. 3-70, Line 22: If FDF pays for the disposal of secondary waste there is little incentive for the vendor to minimize secondary waste volume.

P. 3-71, Line 12: Is there <u>anything</u> in the decant sump tank that would negatively influence any of the treatment processes? If so, then plans are needed to accommodate those materials.

P. 3-79, Line 8: Would there be any value in providing an estimate of the total volume of waste that will be generated by each treatment method: construction, secondary waste, product, D&D?

P. 3-87, 3-88, 3-127, 3-143: These pages refer to the scale-up factors for Vitrification joule heated (VIT 1) and Chemical Stabilization cement based (CHEM 1). Different methods of determining scale-up factors are applied to the two technologies and therefore they are not considered in an equitable fashion. VIT-1 was demonstrated in the POP testing at 0.34 tons per day on a melter designed for 1 ton per day. Scaling up to 15 tons per day is then communicated as a 45:1 scale-up. This is based on the difference between the *demonstrated* scale and the full scale. The CHEM-1 technology was demonstrated at 2.15 tons per day on a facility designed for 8 tons per day. The scale-up factor is given as 10:1. The CHEM-1 scale calculation is done by considering the POP testing facility's *design* capacity—not what was demonstrated. If either method were applied to the two technologies consistently, the scale-up factors would be either 37:1 (CHEM 1) and 45:1 (VIT 1) or 10:1 (CHEM 1) and 15:1 (VIT 1). Instead, the FS inappropriately presents the scale-up factors as 45:1 (VIT 1) and 10:1 (CHEM 1).

P. 3-89, Line 19: Design, construction, startup and operation of additional RCS capacity during or following startup of the treatment system could easily be a "show stopper". This is a problem that should be avoided in design—not during operation. Further, it is inappropriate for the FS to assume design flaws. That is, does the project "tread water" until the increased capacity is provided, or does the facility operate at a reduced throughput? Neither is a good solution.

P. 3-108, Activity 8900: The estimated D&D period of 120 days appears insufficient if D&D includes decontamination, demolition, packaging, transportation and disposal.

P. 3-112, first paragraph: Although the vendor proposed a design producing a frit product, a monolith similar to VIT 1 could be made.

P. 3-115, line 25: This line refers to a "proportional cost increase" as a result of scaling up the melter. A cost increase is incurred, but it is not proportional to scale-up. Increasing capacity of effected equipment would likely increase equipment costs ten percent and project cost much less if incorporated during the design stage.

P. 3-118, line 8: This line states that "redox balancing conditions will remain oxidized." This statement is untrue. The melter can run reducing conditions. Still, the statement is not relevant because oxidizing conditions are desirable. Recommend deleting this whole sentence.

P. 3-118, lines 5 and 6: This text states that lead and sulfates were volatilized out of the melter and this "implies" that the lead must be partitioned from the off-gas and recycled. This is not just an implication—the lead *must* be partitioned and recycled.

P. 3-118, line 15 and 16: Viscosity is also controlled by chemical additions such as Lithium Carbonate.

P. 3-118, lines 19-21: Operability and control of continuous processes such as this is normally less difficult than batch processes because once the system is operational all unit operations are steady state. Batch processes, on the other hand, are constantly varying from start to finish and may or may not be reproducible batch-to-batch.

P. 3-119, lines 16: add "...and to extend ceramic liner life" to the end of the sentence.

P. 3-121, line 2: Again, additional costs are incurred but they are not proportional to capacity increases.

P. 3-121, line 21: add, "and the system design presented has installed excess capacity that can accommodate this (i.e. two full-scale centrifuges and two full-scale dryers)" In addition, remove text referring to a clarifier. This design does not include a clarifier.

P. 3-122, line 4-6: These lines refer to specialized construction techniques, additional unit operations, and integration of multiple components in the off gas system for VIT-2. These items are not challenges to constructability.

P. 3-123, lines 12-15: The wording infers that proof of process surrogate testing, ORR, and SOT is more difficult for this option than the others. The CAT does not understand why.

P. 3-136, line 15: The long-term environmental impacts in this reference don't recognize the much higher radon emanated from the chemically stabilized waste (because it meets the NTS criteria—largely because the site is very remote).

P. 3-142, line 9: Costs would be greater, but not proportional.

P. 3-145, Line 13: It is unclear how a batch mode of operation influences (positively or negatively) operating complexity?

P. 3-146, Line 5: Do manual methods of removing caked material imply maintenance personnel would be performing physically demanding activities while protected by bubble suits?

P. 3-148, line 6: This line claims there is no off-gas system in the design of the CHEM-1 facility. However, there is off-gas control and treatment for particulates and radon. Since there is no gas generation other than radon there is no need for removal of sulfate.

P. 3-148, line 20: The cost increase will be greater but will not be proportional to capacity increase.

P. 3-149, lines 4-8: This technology (CHEM-1) is much less robust per the definition than the other three technologies. Appendix G has an excellent explanation of why it is less robust.

P 3-171, line 12: This text states that there is not an off-gas system included in the estimate. However, there is an off-gas confinement and treatment system for particulates and radon.

P. 4-15, line 11: This line refers to "unique" off-gas systems for vitrification. These off-gas systems, while containing multiple unit operations, are standard commercial industry applications.

P. 4-16, lines 20-22: The VIT-2 option, as presented, has considerable excess capacity for centrifuge and drying operations. As a result, increasing the diameter of the melter would not add significant cost but could increase throughput. The most significant impact from the increase in throughput would be to the RCS system.

P. 4-21, line 17: This line should read, "resulting in a larger number..."

Appendix G Comments

Appendix G overall organization and writing is quite good. However, the section could use more attention to increase its reader-friendliness. The following points would make the section more readable:

- The mass balances should identify streams on the PFD and their SK number. Without this guidance the reader cannot understand what these numbers mean or what they relate to.
- The PFD should immediately follow the mass balance.
- The system numbers are not consistently used in appendix G. The system narrative descriptions and the reference to the system number designations are not identified. For example, G.7.4 Product Handling and G.6.5 Gaseous Emission Control.
- Figures G.4-1, G.5-1, G.6-1 do not show the required product rework functions.
- G.5.1 shows K-65 material as solids in a slurry. G.4.1.1 shows the silos waste solids as K-65 material. G.6.1-1 calls the K 65 material as waste solid. The document should use consistent terminology.

G.2-21, Line 3: Are the secondary waste boxes "standard issue", or must they be specially manufactured, i.e. leaktight? If specialty manufactured, must they be fabricated of any special material?

G.2-17, Line 14: Are the waste containers proven and certified as air-tight, or is this statement an assumption? This becomes important because leakage could mandate negative pressure for the interim storage facility.

P. G.2-17, Line 17: The interim storage facility for the chemical stabilization options is not currently designed to treat radon although the radon will still be released from the treated chemical stabilization waste containers. The treated waste containers are currently supposed to be airtight (G.2-17, Line 17) but they probably won't be—CNS containers definitely will not be. Also, standards require a sloped and decontaminable, floor, curbing and storage such that waste containers cannot set in accumulated liquids.

G.2-25, Line 4: How will need for ventilation of the interim storage area be known until the facility is filled with containers? If at that time radon exceeds limits what would be the resolution?

P. G2-32: This page states that HEPA filters are 99.997 on 3-micron particles. The CAT assumes this is a typo and that the text should refer to 99.97 efficiency on 0.3-micron particles.

Section G.3, general: If this section is intended as a discussion of problems, then the installation, adjustment and extension of the VIT-1 electrodes should be included. The impact of oxidation of these items upon the melt pool should also be included.

P. G.3-3, note 20: This note is incorrect. As can be seen in the VITPP inspection video the refractory was badly cracked contained holes and had missing bricks. Had the bottom drains not failed, the refractory probably would have. If the VITPP is being used as an example, in a three-year operating period the refractory would probably have to be replaced at least twice. It is inappropriate for the document to base assumptions concerning alumina in the waste on this footnote.

P. G.4-41, Line 15: Is the cooling tower blowdown sent directly to AWWT?

P. G.6.1-2: Table identifies the Stream 9 as a 54,000 lb/day and Stream 11 as 1471 lb/day with 64,210 lb/day of additives. The air flow for stream 11 seems very low—should the units be pounds per hour instead of pounds per day?

Comments which should be considered during design phase of the project.

P. 3-89, Line 12: Parallel development and design efforts are typically very difficult to successfully accomplish, and require careful planning, coordination and communication. Frequently, design "blockouts" are used as "placeholders" until development data are available to the design team. Generally, pursuing these efforts simultaneously adds costs because of decreased efficiency, and adds risk because of the possibility of overlooking important information.

P. 3-102, Line 23: Are there time limits for operating the treatment process using the emergency off-gas System and continuing to operate the treatment facility? That is, how quickly must the Off-gas System be returned to normal service before release limits are exceeded?

P. 3-149, Line 20: If an assembly is prefabricated off-site and NDE testing is required (e.g. weld radiography), would those NDE tests need to be repeated following lifting, transporting and installation of the module at the construction site?

P. 3-128, Line 12: Because of the number and type of sources that must be maintained at a negative pressure, there are also many sources of leaks, and a high probability that supplemental RCS capacity would be required. However, this will not be known until the facility is built and operating.

P. A-1-20, 264.35: The fire access requirements could impact the size of both the curing room and the interim storage facility.

P. A-1-23, 264.171-178: The product drums in both the curing room and the interim storage facility must be inspected weekly. Depending upon the definition of inspection, this requirement could significantly impact the design of these facilities

G.2-31, Line 1: At 1.0"wg, a 36"x80" door will require 110 pounds of force to open. May want to consider a door-mounted lever device to "break" the seal and assist in opening Zone 3 doors. This is important to assure the ability of personnel to exit those areas.

P. G.2-32, Line 6: Hanford has recent studies that indicate isokinetic sampling may not be necessary to obtain representative samples. This should be investigated.

P. G.2-32, Line 13: Typically, prefilters are 95% efficient.

P. G.2-38, Line 21: Remote operations, especially those performed via TV, demand excellent visibility and thus better than normal lighting.

P. G.2-62, Line 18: "Gross decontamination" must be defined in measurable terms (e.g. mr/hr at contact, no smearable contamination) to avoid claims.

P. G.4-30, Line 15: Hammermills are notorious for dusting; this presents containment and remote challenges.

P. G.4-31, Lines 1 and 6: Once rework begins, both the glass/concrete breaker and the crane will become contaminated. Decontamination methods and locations should be considered.

BRIEFING PAPER
DOE Independent Review Team

Purpose:

- Evaluate the revised Operable Unit 4 Feasibility Study
- Coordinate with the Critical Analysis Team

Conclusions:

- Document is well written and the analysis is generally fair and balanced.
- All technologies would meet treatment goals.
- "Implementability" is the single most important differentiator between technologies.
  - Scaleup, Innovation and schedule flexibility favors *Non-Joule Vitrification* and *Chemical Stabilization.*
  - All but Scaleup, Robustness and Availability of Vendors favors *Chemical Stabilization* over *Vitrification*.
- There is a general agreement with the CAT Team recommendations.

Recommendations:

- Provide factual supporting statements which explain the positions taken in Figure 4.2-1 – IMPLEMENTABILITY SUMMARY TABLE
- Assure the cost estimate accurately reflects implementability differences (risk budget).

Other Issues/Concerns:

- Secondary waste generation (liquids and solids).
- Bentonite.

NOTE TO FDF: Comments in bold should be addressed in the FS documents. Other comments should be considered if the affected technology is selected.

To: S. McCracken

From: S. Aleman

Date: October 5, 1999

Comments on Draft Feasibility Study Report, 40730-RP-0001

In general, the draft FS report addresses the team's comments generated during the visit the week of February 22, 1999. One of the criteria the team used last February were guidelines from the checklists in the DOE LCAM order, this FS appears to satisfy the criteria. Below are a few comments on the draft report:

1. Page G.4-43 line 20 states that the joule-heated melter load must be manually reduced to 500 kW before the generator is manually started and the manual transfer switch is thrown. Which loads will be taken off? Also, in general, there is no discussion in the alternatives evaluations on impact to operations on loss of power. For example, will de-inventorying of the melter be a problem should an extended power outage be experienced, resulting in a significant quantity of possibly out of spec waste from material to dispose of? Also, I had included as a comment on the POP tests a concern on the cost of D&D of a failed melter as POP test comment, (Comment #9, Table L4.1-1), but I don't see where it is addressed in the FS.

2. Page G.4.5, gaseous emissions: it is unclear whether ammonia nitrate could build up in the system, it appears it could, (page 189 of the EnVitCo POP Test) which would need to be addressed since this would pose an explosion hazard. This potential hazard is not discussed in the Table L.2.2.-1. **Also, in general, the discussion in Table L2.2.-1 and Table L2.4.-1 for "Process Hazards and Mitigators" and "Process Challenges" does not provide the level of detail found in the Tables L2.3.-1 and L2.5.-1. The potential for pressure excursions is discussed in the EnVitCo POP test but not carried over to the table.**

3. Attachment G.4.1 Mass Balance Table, Joule Heated Vitrification: additives for redox control aren't included in the table.

4. Table 3.1-4, page 3-23 states that "control of noble metal a problem with shorting out of electrodes". There's a potential for noble metal buildup to short out the electrodes: this problem has not been experienced with feed sent to date to the DWPF melter, but may be a problem with feeds in the future.

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5. Table 3.1-4 does not in all cases specify the type of waste stream, i.e., high level, and low level. Also, the treatment method is unclear for some of the sites, for example, Hickman, Arkansas.

6. Page 3-42, Table 3.1-6 and page 3-68 and Table 6-6: Another criteria to consider with respect to radon emissions is DOE O435.1, Rad Waste Management. DOE O435.1 supercedes DOE Order 5820.2A.

7. Page 3-91 lines 13-17 states that stabilization of process secondary waste (e.g., elemental lead, radium salts) and D&D residuals would require use of commercial components with demonstrated reliabilities, though treatment of elemental lead and high radium salts from this alternative is not demonstrated and "introduces additional operational risks". These risks should be described and if possible, quantified.

8. Page 30-96, line 2 states: "Controls and trained personnel are required to remove contaminated refractory materials for packaging and ultimate disposal and to apply chemical fixatives (as necessary) to the melter's interior." Where will the contaminated refractory materials be sent?

9. In the vit-other (combustion melter) alternatives evaluation section it states: "increased viscosity in a glass melt will result in reduced production rates and may cause blockages in the melter (this has been a noted problem, particularly in the discharge orifices of DOE melters)." Viscosity was not the root cause of the DWPF pouring problems. Viscosity was a causal factor, but pour spout geometry was the root cause of pouring problems experienced with the DWPF melter operations.

10. Table L.4.1-, page L4-3 comment #3: The response does not address my concern that the waste form made from secondary waste steams (salt, metals and off-spec material) may not meet the NTS WAC.

11. Table L.2.3-1 page L-2-22 states "Recycling of lead and sulfates back into the primary treatment process may accumulate on the glass pool and result in an undesirable phase separations." This is a concern that will have to be addressed.

12. Section 6.2.6, of the EnVitCo POP test, Secondary Waste, states on page 155 that additional studies will be required to determine the optimum filtration/removal techniques for Se. Also, page 156 states that further testing on the volatility of Po will be required prior to final design of the full-scale treatment system. Where are the costs of these additional studies represented?

13. The comments from Christine Langton should be deleted from the FS report. I faxed her the responses to her comments and she said they have all been addressed but would rather not have her comments incorporated.

Note to FDF: the following comments had been submitted previously to Mike Connors of FDF, his responses are NOT included to allow for potential revisions by FDF.

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439-4815

Telephone 630/252-3728
FAX 630/252-6500

Mr. Steve McCracken
Department of Energy
Weldon Spring, MO

Subject: Preliminary Review of Volume 2 of "Revised Feasibility Study Report for Silos 1 and 2" Dated September 1999

Dear Mr. McCracken:

The above-cited document, which contains Appendix C ("Cost Estimate"), was preliminarily reviewed by the Argonne team. It is understood that the document is still within the draft stage and therefore future revision may occur.

In general, this author is satisfied with the contents of Appendix C. The majority of the outstanding cost issues have been addressed or in the process of being addressed, based upon reviews of the four cost estimates performed earlier this month. The comments provided with this memo in general are minor in nature and (probably) result from the continuous evolution of the four cost estimates. Comments also have been included that would (hopefully) contribute to the understanding of the cost estimating process by the public.

Please supply the comments and information given in this document to the appropriate persons. A copy of these comments has been forwarded to Dave Yockman, DOE/FEMP, and to Mike Connors, FDF. If you have any questions, please feel free to contact me at (630) 252-3728.

Respectfully yours,

Steve Folga

cc: M. Connors (FDF)
M. Davis (ANL)
J. Gillette (ANL)
D. Yockman (DOE/FEMP)

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Comments on "Revised Feasibility Study Report for Silos 1 and 2, Volume 2 of 5," dated September 1999

1. This is a minor comment but the last sentence in the second paragraph on page C-1-1 states "but do not offer commensurate performance or effectiveness." The word "performance" should be revised to become "implementability" to agree with the NCP.

2. The following is a suggestion that may make Appendix C more understandable to the public. Section C.1.2 on page C-1-2 provides a listing of the eight major cost components associated with each alternative. It maybe helpful to include within the text a concise description of each cost component, indicating what cost sub-elements are includes. As an example, it may be advisable to indicate where the costs of disposition for the treatment residuals would be located. It could in general be included with the annual O&M costs and also with the waste packaging and shipping cost.

3. This is another minor comment but it may be advisable to consider revising the last sentence on page C-1-3 to state that "It is assumed that debris from the D&D of the Silos 1 and 2 material full-scale treatment facility, *when suitably packaged*, meets the Nevada..." The existing statement appears to indicate that the D&D waste could be shipped to NTS, as is, which is not the case.

4. Similarly, the first sentence on page C-1-4 may be revised to state that "It is assumed that any secondary wastes from the Silos 1 and 2 material treatment operations, *when suitably treated and packaged*, meet the NTS WAC."

5. Another minor comment, but it may be advisable to consider revising the heading of the third column in Tables C-1-4-1 and C.1.4-2 (on pages C-1-6 and C1-7) from "Comment" to "Data Required for Cost Estimation" or something similar.

6. The last sentence on page C-1-7 is confusing, as it seems to indicate that the project management cost consists, in part, of the cost of FDF project management support. In general, project management oversight includes activities such as human resources, project controls, environmental monitoring, etc. It may be advisable to consider revising the statement in the text.

7. This is a general comment applicable to all four alternatives. It may be advisable to consider decreasing the number of significant digits shown in the estimated costs. As an example, page C-2-1 indicates the summary cost (un-escalated) for the Vitrification – Joule-Heated alternative to be $291,688,715. However, the text on page C-1-1 indicates the accuracy of the estimate to be on the order of +50/-30% which weighs against showing costs down to a single dollar.

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8. This is a suggestion that may make the four cost estimates more understandable to the public. The "Control Summary Estimate" sheet (which is provided as an attachment to

Section C.x.1) indicates the breakdown of all relevant costs. However, the sub-total at the top of the page includes both Capital (Section C.x.2) and Engineering (Section C.x.3) costs, which is somewhat confusing. It may be helpful to indicate the major cost elements (e.g., capital, engineering, O&M, D&D, etc.) explicitly and to include the costs of significant cost sub-elements (e.g., capital direct/indirect, construction management, etc. under capital) under each major cost element. In this way, the reader would be able to look at the major cost sub-elements for each major cost elements and refer to the appropriate section within Appendix C.

9. This is a minor comment but examination of Table C.2.2-1 on page C-2-4 indicates that the work breakdown structure (WBS) for the detailed cost elements is "C.2.2.2.4" while the total capital cost has a WBS of "C.2.2.1." In general, the numerical designation of the rolled-up cost should be the same as that of the more detailed costs.

10. Similarly, it may be helpful if the text indicates that the Risk Budget shown in Table C.2.2-1 on page C-2-4 includes the 15% contribution from the cost of engineering/inspection/design.

11. Another minor comment but the fifth bullet on page C-2-5 is confusing. ("Engineered machinery and equipment pricing is obtained from engineering *manuals and equipment sales* specialists and includes freight to the jobsite"?)

12. Page C-2-6 indicates that the capital cost estimate includes "Contingency" which is presumably considered to incorporate any additional potential risk to DOE associated with the capital cost estimate. However, the total costs shown in Appendix C do not appear to include the costs of contingency. DOE's *Cost Estimating Guide, Volume 6*, available at http://www.fm.doe.gov/fm-20/costest.htm, indicates that extra contingency allowances should be avoided. If DOE believes that the costs of contingency are to be included within this cost estimate, then it may be advisable to revise all four cost estimates to incorporate this cost element. If however DOE thinks that the major elements of a contingency analysis are incorporated within the risk budget costs present within the estimates, then it may be advisable to remove the word "Contingency" from this page (and all other associated pages) to avoid confusion.

13. Page C-2-30 indicates that spare parts would be required only during the 3.5 years of POP testing and operations. It may be argued that spare parts would also be required during start-up.

14. Page C-2-36 indicates a D&D Risk Budget of $1,234,400 which does not agree with the risk budget for either the treatment facility D&D (at $1,267,200) or the Support Area D&D (at $1,174,500). In fact, it would be expected that the D&D Risk Budget shown in Table C.2.5-1 should be the summation of the two previously mentioned values (i.e., $1,234,400+$1,174,500 = $2,408,900).

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15. Page 3 titled "REPORT Joule Operations & Maintenance Risk" indicates a risk budget percentage of 12% and a total operations and maintenance cost of $117,421,901. However, application of a risk budget percentage of 12% to the individual costs shown in Table C.2.4-1 on page C-2-22 does not result in the risk budget of $13,350,180 shown in this table (12% * [$59,390,013 + $8,484,287 + $1,040,736 + $9,271,724 + $5,917,380 + $1,439,870 + $2,109,000] ~ $10,518,000) and the value in the table appears to be about 29% too great.

16. Another minor point. Page C-2-36 indicates a Silo Project Support Area D&D Cost of $10,468,800 while the "Estimate Summary Sheet" indicates a cost of $10,774,799.

17. Similarly, the D&D NTS Disposal Cost of $11,174,592 shown on page C-2-36 does not agree with the summed costs of $8,693,800 taken from the two "Estimate Summary Sheets." Is the difference due to application of risk budget to the D&D NTS Disposal cost? If yes, please state this in the text and indicate the risk budget percentage applied for this cost element.

18. Another minor point. Table C.2.6-1 on page C-2-43 incorrectly indicates the annual FDF project management cost to be $2,115,160 which does not agree with the schedule duration of 10.5 years and a total project management cost of $22,145,800 (i.e., $22,145,800 / 10.5 years = $2,109,123 per year).

19. The unit disposal cost is stated to be $7.05 per cu.ft. on page C-2-54 while the actual unit disposal cost used in the calculations is $7.50 per cu.ft. It may be advisable to revise the text.

20. The text indicates a total waste disposal cost of $23,736,225 on page C-2-49 while page C-2-1 indicates a cost of $25,601,270. Is the difference due to risk budget application? If yes, then the apparent risk budget percentage of 7.9% (i.e., $25,601,270/$23,736,225 – 1) appears low. Please indicate in the text how the waste disposal cost of $25,601,270 was estimated, and revise Table C.2.7-1 to include the costs of Risk Budget.

21. The following table provides a comparison of the major cost elements for the four alternatives, based on the entries shown in Table C.x.1-1 (Summary Cost Estimate for XXX). It appears that the Project Management and Waste Disposal costs have been incorrectly placed in the Table C.3.1-1 for the chemical stabilization –cement alternative.

Major Cost Element	Joule-Heated Vitrification	Vitrification - Other	Chemical Stabilization - Cement	Chemical Stabilization - Other
Capital Cost	$ 66,119,853	$ 65,943,143	$ 52,813,643	$ 51,783,983
Engineering Cost	$ 25,050,900	$ 25,050,900	$ 23,808,860	$ 23,808,860
Operation and Maintenance Cost	$ 101,183,190	$ 109,996,098	$ 57,413,976	$ 69,344,894
D&D Cost	$ 34,503,692	$ 38,232,830	$ 33,716,309	$ 36,356,603

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Project Management Cost	$ 22,145,800	$ 22,145,800	$ 57,560,520	$ 21,151,600
Waste Disposal Cost	$ 25,601,270	$ 21,866,861	$ 21,151,600	$ 56,555,860
Cost of Money	$ 17,084,010	$ 18,205,999	$ 14,599,114	$ 13,684,340
Total	$ 291,688,715	$ 301,441,631	$ 261,064,022	$ 272,686,140

22. Page C-3-35 indicates that the "risk budget for the Vitrification – Other was determined to (be) 15% of operation, maintenance, and project management costs." However, the attached risk budget analysis indicates a 24% value, based upon the page titled "REPORT2" and labeled "Page 3." The value actually used in the cost estimate appears to lie between 15% and 24%.

23. Another minor point. Table C.4.4-1 on page C-4-24 indicates a Consumable (PPE and Supplies) cost of $3,977,400 which is much lower than the other technologies. It appears that the costs of PPE and Supplies was not considered in the development of O&M costs for the Cement Stabilization – Cement alternative, and should be included in the Final FS.

24. Page C-4-36 indicates that the "risk budget was determined to be 12% of operation, maintenance, and project management cost." However, the attached risk budget analysis indicates a 25% value, based upon the page titled "REPORT2" and labeled "Page 3." The value actually used in the cost estimate appears to lie between 12% and 25%.

25. Review of Section C.4.7 (Waste Disposal, Cost Estimate) appears to indicate that a risk budget calculation was not performed nor included for the Chemical Stabilization – Cement-based alternative.

26. This is a minor point given the status of the document, but the values shown in Table C.5.4-1 on page C-5-23 do not agree with the text later in this section.

27. The Risk Budget cost of $2,884,120 is not shown in Table C.5.7-1 on page C-5-49, nor are the details of how this value was calculated.

28. This is a global question which probably has been resolved, but the FDF Project Management cost is estimated to be approximately $22,145,800 for the two vitrification alternatives, based upon a total duration of 10.5 years. The similar cost for the two chemical stabilization alternatives is estimated to be $22,151,600, based upon a total of 10 years. It is not intuitive to this reviewer why the cost would be higher for the shorter duration project.

000035

2621

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439-4815

Telephone 630/252-3728
FAX 630/252-6500

Mr. Michael Connors
Fluor Daniel Fernald
7400 Willey Road
Hamilton, OH 45013

Subject: Preliminary Review of Volume 1 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Cement Stabilization" Dated September 1999

Dear Mr. Connors:

The above-cited document was preliminarily reviewed by the Argonne team. Comments associated with Volume 2 of the above-cited document will be provided early tomorrow. It is understood that the document is still within the draft stage and therefore future revision may occur. Therefore the following comments should not be taken as criticisms but only points to consider in the final document.

Please supply the comments and information given in this document to the appropriate persons. As instructed, a copy of these comments has been forwarded to Dave Yockman, DOE/FEMP. If you have any questions, please feel free to contact me at (630) 252-3728.

Respectfully yours,

Steve Folga

cc: M. Davis
J. Gillette

000036

Review of Volume 1 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Cement Stabilization" Dated September 1999

1. This is a minor comment. Page 8 of 10 of the section titled "Introduction and Estimate Basis" does not include a write-up on the development of costs of "Temporary Utility Hook-Up."

2. Review of section A/C 100 ("Concrete") appears to indicate that the design for the Product Handling & Store Building assumes a concrete monolith structure with concrete walls. However, review of available literature such as the *Cost Estimate Supplement to the Operable Unit 5 Feasibility Study, Fernald Environmental Management Project* (November 1994) assume that the walls for a cement stabilization facility would be constructed of metal siding. Given the low temperatures and lack of energetic processes associated with cement stabilization, a metal-sided structure might have been expected.

3. The major capital cost item for A/C 300 ("Architectural") appears to be that associated with the activity named "16. Install coated poly. Bldg. cover." A unit labor rate of 0.112 person-hours per square foot is applied. A review of activity 130 111 ("Air Supported Structures") in the document *Building Construction Cost Data, 57th Annual Edition* (R.S. Means, 1999) indicates a labor rate ranging from 0.005 to 0.011 person-hours per square foot.

4. A review of A/C 400 ("Machinery & Equipment") indicates that it does not appear to include equipment to heat the various buildings. Unit heaters are provided for the Warehouse and Warehouse Office, but not for the Product Handling & Store Building, etc.

5. A major capital cost item for Piping, Electrical, Instruments/Controls, and Insulation is associated with bulk quantities. Estimates of these bulk quantities are supplied in the Section in Volume 1 titled "Factored Bulk Materials." However, the values in this section do not always agree with those within the various Code of Account sections. As an example, Section A/C 500 ("Piping") indicates a material cost of $148,630 while Section "Factored Bulk Materials" indicates $145,000.

6. The major capital cost item for A/C 800 ("Paint & Insulation") appears to be that associated with the activity named "5. Paint masonry." An unit labor rate of 0.02 person-hours per square foot is applied, with an unit material rate of $0.39 per square foot. A review of activity 124 0350 ("Walls, Masonry (CMU)") in the document *Building Construction Cost Data, 57th Annual Edition* (R.S. Means, 1999) indicates a labor rate ranging from 0.003 to 0.013 person-hours per square foot, with an unit material rate between $0.02 to $0.07 per square foot.

7. The Section titled "Mobilization" appears to have a number of potential inconsistencies. The car leasing cost of $12,000 appears excessive given the six-month length for Start-Up. Also the total relocation cost of $60,000 per person appears to be quite high.

8. There appears to be an inconsistency in the development of the Factored Bulk Materials. The handwritten backup sheet makes reference to System No. 43, which does not exist on page 3 of the Section titled "Introduction and Estimate Basis."

9. The costs shown in the Section titled "Engineering Costs" appear excessive in comparison with available literature for cement stabilization of waste materials. As an example, the document *Cost Estimate Supplement to the Operable Unit 5 Feasibility Study, Fernald Environmental Management Project* (November 1994) indicates an Engineering, Design, and Inspection cost of $3,175,000 out of a total capital cost of $55,801,795 (or about 5.7% of the total). This cost estimate indicates an Engineering, Design, and Inspection cost of $23,808,860 out of a total capital cost of $38,810,643 (or about 61.3% of the total).

10. A preliminary review of the Section titled "Risk Budget" indicates a fairly tight range of –1% to 10-15% was applied to determine the risk budget of the capital costs. Generally at the preconceptual stage of design and cost estimation, ranges on the order of –15% to –20% and +30% to 40% may be expected.

11. The cost values used in the Risk Budget appear to be inconsistent. The following table indicates the direct costs taken from the Estimate Summary Sheet and the total (direct and indirect) costs used in the Cost Impact Matrix Sheet.

Cost Element	Estimate Summary Sheet	Cost Impact Matrix Sheet	Ratio of the Two Values
Civil & Excav. All Facilities - Labor	$202,993	$434,760	2.14
Concrete All Facilities - Labor	$1,928,700	$5,072,630	2.63
Structural Steel - All Facilities - Labor	$336,300	$882,680	2.62
Arch./Build's/Finishes - All Fac. Labor	$693,000	$1,826,410	2.64
Equipment System 1-94 - Labor	$542,500	$1,427,710	2.63
Piping - Labor	$255,100	$671,350	2.63
Instrumentation - Labor	$198,700	$522,920	2.63
Electrical - Labor	$1,017,800	$3,061,210	3.01
Paint/Insulation - Labor	$238,800	$627,930	2.63
Mobilization - Labor	$60,000	$150,250	2.50
Civil & Excav. All Facilities - Material	$98,250	$75,160	0.76
Concrete All Facilities - Material	$1,244,400	$1,752,040	1.41
Structural Steel - All Facilities - Material	$880,000	$1,241,540	1.41
Arch./Build's/Finishes - All Fac. Material	$1,362,900	$1,925,390	1.41
Piping - Material	$247,800	$349,230	1.41
Instrumentation - Material	$1,208,600	$1,702,730	1.41
Electrical - Material	$1,092,300	$1,724,930	1.58
Paint/Insulation - Material	$113,700	$160,140	1.41
Electrical - Equipment	$887,100	$1,225,590	1.38
Equipment System 1-94 - Equipment	$10,323,700	$14,264,310	1.38
Mobilization - S/C	$669,600	$806,530	1.20

It appears that an inconsistent method was applied to estimate the total (direct plus indirect) costs for the following cost elements:

- Civil & Excav. All Facilities – Labor
- Electrical – Labor
- Mobilization – Labor
- Civil & Excav. All Facilities – Material
- Electrical – Material

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2621

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439-4815

Telephone 630/252-3728
FAX 630/252-6500

Mr. Michael Connors
Fluor Daniel Fernald
7400 Willey Road
Hamilton, OH 45013

Subject: Preliminary Review of Volume 2 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Cement Stabilization" Dated September 1999

Dear Mr. Connors:

The above-cited document was preliminarily reviewed by the Argonne team. Due to unexpected events, it was not possible to send these comments earlier, as had been indicated yesterday. It is understood that the document is still within the draft stage and therefore future revision may occur. Therefore the following comments should not be taken as criticisms but only points to consider in the final document.

Please supply the comments and information given in this document to the appropriate persons. As instructed, a copy of these comments has been forwarded to Dave Yockman, DOE/FEMP. If you have any questions, please feel free to contact me at (630) 252-3728.

Respectfully yours,

Steve Folga

cc: M. Davis
J. Gillette

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Review of Volume 2 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Cement Stabilization" Dated September 1999

12. This is a minor comment. The page titled "Operation and Maintenance Estimate Basis, Cement Stabilization" states within the assumptions that "Labor costs are based on three crews working a 40 hour/week schedule..." However, review of the Section titled "Labor Costs" appears to indicate four shifts.

13. This also may be a minor comment. Page 3 of the Section titled "Introduction & Estimate Basis" indicates that the O&M costs are composed of five major elements; i.e., FDF labor, material, utility, contractor's technical support, and risk budget. However, the costs associated with the disposition of secondary wastes generated during normal operations and maintenance (e.g., spent HEPA filters, surface-contaminated failed equipment, etc.) do not appear to have been considered. Given that the D&D cost estimate assumes all wastes to be radiologically contaminated, it may be appropriate to assume all replaced/failed equipment would also be treated as radiologically contaminated requiring packaging, shipment, and disposal at the NTS.

14. Another minor comment. Page 4 of the Section titled "Introduction & Estimate Basis" indicates that the "Utility costs estimate were based on information provided by the Proof of Principle contractor." Utility costs are defined in the previous page to include "electricity, natural gas, and oxygen." It is my recollection that the POP contractors did not provide the amount of natural gas required for space heating, gasoline used for on-site shipping, etc. If these utilities are neglected within the cost estimate, it may be advisable to include this assumption within the Estimate Basis.

15. The Detailed Estimate Worksheet in the Section titled "Summary Operations & Maintenance Costs" indicates that "Spare Parts/Consumables" are expected to be required for 3 years, presumably the period of operations. However, it may be expected that Consumables would be needed during the 6-month period for Start-Up activities (resulting in a total duration of 3.5 years).

16. The Section titled "Labor Costs" provides a breakdown of the operations and maintenance manpower. It indicates that a total of 93 FTEs are required for operations, and 71 FTEs for maintenance. A review of the available literature concerning cement stabilization indicates agreement with the number of operations workers for this processing rate, but that the number of maintenance workforce may be excessive. One standard rule-of-thumb for estimating maintenance workforce is that the annual maintenance labor cost is 250% of the annual maintenance material cost, and that the annual maintenance material cost is 7% of the equipment capital cost. In this case, the annual maintenance labor cost would be on the order of $2.5 million, compared with the approximate $4.4 million shown on this table.

000041

17. The same table indicates that 5 rad technicians are needed during the first shift to monitor a total of 87 FTEs (one per 17.4 FTEs), 3 rad techs are needed during the second shift to monitor 44 FTEs (one per 14.7 FTEs), 2 rad techs per 17 FTEs for the third shift (one per 8.5 FTEs), and 2 rad techs per 4 FTEs for the fourth shift (one per 2 FTEs). Is it standard practice at the site to always have at least a team of 2 rad techs independent of the number of persons monitored?

18. This may be a minor comment, but it may be advisable to include within the text the logic why two Control Room Operators would be needed during the third and fourth shifts when the plant would not be operating. It should be noted that the same number of Control Room Operators (two) would be present during the Second Shift when the plant would be operating.

19. The first page of the Section titled "Material Costs" provides the method by which the costs for PPE were estimated. It indicates that a total of 25,252 mandays over the 3.5 year start-up/operations period would be spent under Level C PPE conditions, and 50,505 mandays under modified Level C PPE conditions. This results in a total of 75,757 mandays over the 3.5 years, or 21,645 mandays per year. Assuming 200 mandays per FTE-year, this indicates that PPE would be provided for approximately 108 FTEs. However, the table titled "Operations and Maintenance Manpower, Chemical Stabilization – Cement" within Section "Labor Costs" indicates only a small fraction of the total workforce (i.e., 164 FTEs) would be subject to exposure from Radiation Zones 2 through 4.

20. This is a very minor comment, but my version of Volume 2 contained the Risk Budget sheet for Joule Heated Vitrification within the Section titled "Material Costs."

21. The Section titled "Utility Costs" provides the annual costs of the various operations consumables and utilities. The sheet indicates a total annual cost of $7,058,187; however, summation of the individual costs results in a total of $5,826,552.

22. As stated in comment no. 3, the Section titled "Utility Costs" does not appear to consider the cost of consumables such as natural gas for space heating, mobility fuels such as gasoline, etc. Given the difference in building sizes between options, the number of waste packages shipped, etc., it would be expected that these annual costs would not be the same between the four options. It should also be noted that the Section titled "Labor Costs" indicates 2 Motor Vehicle Operators who presumably would be driving vehicles consuming gasoline, etc..

23. This is only a suggestion, but it may be helpful to include more details concerning the various cost elements in the Section titled "Utility Costs" such as the annual quantity of consumables and their material costs, replacement frequency and installation costs for spare parts, etc.

24. The Section titled "Risk Budget" appears to have a number of inconsistencies between the values shown in the Detailed Estimate Worksheet and those used in the Risk Budget analysis, as shown below:

Cost Element	Detailed Estimate Worksheet	Risk Analysis Input	Agrees?
Start-up testing	$1,154,320	$1,183,180	NO
Utility	$3,251,030	$2,856,260	NO
Spare Parts	$908,310	$908,307	YES
Health Physics	$3,251,030	$3,879,200	NO
Subcontractor Oversight	$2,208,960	$2,264,180	NO
Labor	$37,496,260	$37,496,256	YES

25. The bottom of the page titled "Decontamination and Demolition Estimate Basis, Cement Stabilization" indicates that the costs of "Waste packing and transportation labor" were included within the estimate. However, it is not clear whether the costs of transporting the D&D waste to NTS were included.

26. The Section titled "Remediation Facility D&D Cost Estimate" indicates a labor cost of $427,500 for Supervision – Contractor, which is approximately 42% of the total direct field labor cost. The estimate basis for capital construction indicated that this cost item for construction would be 17% of the total direct field labor cost. The labor cost of $427,500 appears excessive.

27. In addition to comment no. 15, it appears that a per diem cost of $134,400 has been assumed for supervision of the D&D contractor. It is not clear why this cost item would be necessary assuming that on-site personnel would perform supervision of the D&D contractor. If it were assumed that off-site personnel would be required, then why would this not also be the case during construction?

28. In addition to comment no. 15, the labor costs for Construction Management are $1,561,149, which are approximately 44% of the sum of the labor costs (approximately $3.5 million). This appears to be excessive.

29. It does not appear that the costs of off-site transportation of D&D wastes to NTS have been included. The NTS Burial Fee is shown to be $4,147,271, which agrees with the unit disposal cost of $7.5/ft^3 and a total D&D disposal volume of 552,960 ft^3.

30. The Equipment Rental cost of $705,600 appears to be a constant, independent of the four remediation options. Further information indicating how this cost was estimated would be helpful.

31. The page titled "D&D Cement Stabilization" within Section "Remediation Facility D&D Cost Estimate" provides the volume of unbulked and bulked materials. It appears that the

000043

bulked volume of metals (237,844 ft^3) does not agree with the unbulked volume of 69,954 ft^3 and the bulking factor of 3.

32. This is only a suggestion, but it appears that the D&D cost estimate is applying unit D&D rates based upon historical operations at the site. It is not clear whether these rates would be applicable for the case of a new facility which would be built taking into account during the design phase its ultimate D&D. Given this, it may be more appropriate to consider using D&D rates from standard cost engineering manuals such as the ECHOS *Environmental Restoration: Unit Cost Book* (published by R.S. Means and Delta Technologies Group, Inc.) which are more specific to the component undergoing removal. As an example, a unit rate of 20 man-hour per ton is applied in this estimate for all process equipment. The ECHOS manual indicates however that removal of a 1 hp pump would require 2.33 man-hours while a 50 hp pump would require 9.33 man-hours. The variation in unit rates takes into account the weight and bulkiness of the item as well as any dismantling of attached wiring, piping, etc. that may be necessary.

33. The Section titled "Basis of Estimate" under the "Project Management Cost Estimate" indicates that the project duration ranges from FY00 through FY10, which is a total of 11 years. However, the Section titled "Total Cost Summary" under the "Project Management Cost Estimate" indicates a uniform total of 20,800 man-hours, which is indicative of 10 years.

F-2621

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439-4815

Telephone 630/252-3728
FAX 630/252-6500

Mr. Michael Connors
Fluor Daniel Fernald
7400 Willey Road
Hamilton, OH 45013

Subject: Preliminary Review of Volumes 1 and 2 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Vitrification Other - Combustion" Dated September 1999

Dear Mr. Connors:

The above-cited documents were preliminarily reviewed by the Argonne team. It is understood that the documents are still within the draft stage and therefore future revision may occur. Therefore the following comments should not be taken as criticisms but only points to consider in the final document.

Please supply the comments and information given in this document to the appropriate persons. As instructed, a copy of these comments has been forwarded to Dave Yockman, DOE/FEMP. If you have any questions, please feel free to contact me at (630) 252-3728.

Respectfully yours,

Steve Folga

cc: M. Davis
J. Gillette
S. McCracken
D. Yockman

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Review of Volume 1 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Vitrification Other - Combustion" Dated September 1999

1. The fifth bullet on the page titled "Silo 1&2 Feasibility Study, Cost Estimating Assumptions" indicates that "Fluor Daniel Fernald will provide the site infrastructure in support of the Silo 1&2 waste treatment facility," including natural gas. The cyclone vitrification technology consumes relatively large quantities of natural gas. Has the capacity of the local natural gas infrastructure been checked to see if it is capable of delivering the required quantity of natural gas? If upgrades of the site infrastructure are necessary, to accommodate a given remediation technology, will these costs be included within these cost estimates?

2. The Section labeled "General Assumptions and Program Plan" contains a sheet titled "Control Estimate Summary." This sheet indicates that the Utility costs will be incurred over a 4-year period, presumably indicating both a 1-year startup and 3-year operation periods. However, the time period for the Spare Parts and the Consumable cost elements is shown to be only 3.5 years. Given that the startup period of 1 year will potentially entail consumption of materials and replacement of failed parts, it may be advisable to consider a 4-year period for these two cost elements also.

3. Also, the above-cited table indicates the total cost of "Waste Disposal (PKG & Transport)" to be $16,038,961. However, Volume 2 indicates this cost to be $16,225,518. This may be due to differences in the costs of labor, subcontracts, material, and equipment between the two volumes. As an example, the equipment cost in Volume 1 is $740 while in Volume 2 it is $760. It may be advisable for FDF to perform a detailed comparison of the costs between the various volumes of the cost estimates.

4. Again referring to the same page, it appears that the spreadsheet used to develop the cost summations contains errors. As an example, the total equipment cost of $17,818,000 does not include the $740 value for "Waste Disposal (PKG & Transport)." Also, the total project cost does not equal the summation of the individual cost elements. It may be advisable to check the formulas within this table.

5. Generally a Feasibility Study (FS) includes information concerning the life-cycle costs (LCCs) of a given alternative. The life-cycle costs may be shown both in non-discounted (as depicted in the above-cited table) and in discounted dollars. In the LCC approach, both discount and escalation rates must be considered. The most used method of LCC analysis is the net present worth method. Generally, the comparison of different alternatives in an FS is by the net present worth method (DOE's *Cost Estimating Guide, Volume 6*, available at http://www.fm.doe.gov/fm-20/costest.htm). However, presentation of the total project costs in discounted form does not appear to have been included within any of the four cost estimates. It may be advisable to include a section on LCC including the assumptions, methodology, assumed dispersal of costs by year, etc. as well as a table indicating the discounted dollars for the various cost elements shown in the above-cited table. (The Section in Volume 2 labeled "Cost of Money" would not be considered a

000046

LCC estimate in that it excludes costs such as those associated with disposal at NTS that will be only paid by DOE.)

6. Page 4 within the Section labeled "Capital Cost Estimate" indicates that the Construction Management Costs include the "costs for hooking up and supporting construction temporary trailers, supplies, and utilities." It appears that the costs for these activities have already been included within the indirect cost elements "Temporary construction facilities" and "Temporary Utilities." If this is the case, it may be advisable to exclude within the cost estimate these two indirect cost elements; otherwise the potential exists for double counting.

7. This is a minor comment. Page 8 of 10 of the Section labeled "Capital Cost Estimate" does not include a write-up on the development of costs of "Temporary Utility Hook-Up" and "Job Site Access and Job Specific Training." In addition, the methodology outlined on this page concerning the "Safety" cost element does not match its development within the cost estimate.

8. The Section labeled "Introduction and Estimate Basis" contains a page titled "Estimate Summary Sheet." On this page, the costs of Mobilization are shown to be $729,600, out of a total direct cost of $30,688,243. Excluding its contribution to the total direct cost, the Mobilization cost is approximately 2.4% of the corrected direct cost (i.e., $729,600 / [$30,688,243-$729,600]). RS Means' *Environmental Remediation Estimating Methods* (1997) indicates on page 548 that the costs of mobilization should be on the order of 0.4% of the direct cost, for direct costs in the range between $15 to $30 million. This appears to be a significant difference. This may be due to the number of persons (10 total) assumed to be relocated at FDF's expense. As an example, Appendix D (Full-scale Plant Cost Estimate) of the document *Silo 1 and Silo 2 Proof of Principle Project* (BFA-4200-809-002, April 30, 1999) submitted by Vortec Corporation to FDF indicates that Vortec Corporation assumes only 6 people would provide support during plant operations, and then only on a part-time basis (between 8 to 16 hours per week). It may be advisable to reconsider the number of personnel relocations and re-estimate the costs of Mobilization for the four cost estimates.

9. The page titled "Estimate Summary Sheet" indicates an Equipment cost of $9,800 during "Civil & Excavation All Facilities," which does not appear in the development of these direct costs. In addition, the total direct cost for "Civil & Excavation All Facilities" is shown in this table to be $315,143 which does not agree with the value of $274,200 shown later in Volume 1.

10. The page titled "Detail Estimate Worksheets" in the Section labeled "Direct Cost Summary" indicates the various activities associated with "Civil & Excavation All Facilities." It shows that the cost estimate considers the extension of water and electrical utilities to the proposed treatment site. The cyclone vitrification technology considered in this cost estimate consumes relatively large quantities of natural gas. However, it does not appear that the potential extension of natural gas pipelines to the proposed treatment site

has been considered for this technology, and it may be advisable to include it. (This activity would not be considered to be a "Site Hotel" cost, as natural gas is necessary for operations.)

11. This author did not have the time to fully review the individual activities associated with the various direct cost components. However, a cursory review of the Section labeled "A/C 400, Machinery & Equipment" indicated a number of inconsistencies between the capital equipment costs shown in this section compared with the costs provided in Appendix B of the cost estimate:

Description	Equip. No.	Vol. 1 Cost	App. B Cost
Slurry Receipt Tank Agitator	15-AG-006	$35,400	$40,435
Combustion Melter	17-PE-001	$4,000,000	$3,012,000
Filtrate Pump	18-PM-007A/B	$14,800	$14,600
Scrubber Caustic Pump	18-PM-004A/B	$2,200	$2,100
Off-Gas Bypass	20-FA-002A/B	$10,600	$10,400
Quench Tank Vent Condenser	23-HE-002	$6,800	$6,400
Rework Bridge Crane	26-CN-001	$400,000	$68,000
Operations Area Air Handling Unit	73-AH-001	$24,000	$36,000
Melter Room Fan	73-FA-002A	$1,300	$5,100
Melter Room Fan	73-FA-002B	$1,300	$5,100
Melter Room Exhaust Fan	73-FA-003A/B	$14,000	$18,400
Melting Room HEPA	73-FL-001A-C	$135,000	$119,600
Rework Room HEPA	73-FL-003A-C	$24,000	$179,400
Wall Louver	73-ME-001-006	$5,400	$5,100
Vit. Bldg. Stack	73-ST-001	$70,000	$100,000
Subtotal:		$4,744,800	$3,622,635
Difference:		$1,122,165	

12. A cursory review of the unit manpower rates shown in the Section labeled "A/C 400, Machinery & Equipment" indicated a number of inconsistencies with those shown in the U.S. Army Corps of Engineers' *Unit Price Book*. The *Unit Price Book* is actually a very detailed database containing approximately 19,000 line items and is used nationwide. A cursory spot check indicated the following potential inconsistencies:

Description	Equip. No.	FDF Manhours	*Unit Price Book* Manhours	Variance (%)
Slurry Receipt Tank Agitator	15-AG-006	100	40-46	117-150%
Centrifuge	15-CE-001/002	180	71-144	25-153%
Dryer Condenser Cooler	15-HE-001	60	363	-83%
Slurry Receipt Tank	15-TK-001	320	132	143%
Forced Draft Fan	17-FA-001	20	10	100%
EOG Knockout Tank Filter	18-FL-002	80	15	433%
Quench Tower	18-PE-001	200	128	56%
Carbon Bed	20-RN-003	120	80	50%
Operations Area Air Handling Unit	73-AH-001	55	21	162%
HVAC Room Air Handling Unit	73-AH-002	65	29	124%

000048

Description	Equip. No.	FDF Manhours	*Unit Price Book* Manhours	Variance (%)
Melter Room Bridge Crane	80-CN-001	250	68	268%
Maintenance Shop Crane	80-CN-003	200	34	488%

It should be noted that the Air Force sponsored *Remedial Action Cost Engineering and Requirements* (RACER) software has been recommended by DOE's Applied Cost Estimating team and is now widely used within DOE for check estimates and calculations of future costs (http://www.em.doe.gov/aceteam/activ.html, accessed on September 17, 1999). The U.S. Army Corps of Engineers' *Unit Price Book* is the basis for the unit manpower and costs used in the RACER software. A brief comparison by ANL of the unit manpower rates used in this cost estimate with other cost-estimating references (e.g., RS Means, Richardson's) also noted discrepancies.

A cursory review of the unit manpower rates for the various pieces of equipment indicate the use of "round" numbers with (in general) only one degree of significance (i.e., 400, 10, 300, etc.), unlike those provided in the *Unit Price Book* and other cost estimating references. It may be advisable for FDF to review the unit manpower rates used in this cost estimate with those provided in standard cost estimating manuals and to supply the basis of the unit manpower rates used by FDF in the text. If the review indicates unit manpower rates consistently different from those applied in the cost estimate, it may be advisable to revise the rates to reflect industry practice.

13. The costs shown in the Section titled "Engineering Costs" appear excessive. Guidance on page 254 of the U.S. Department of Energy's *Cost Estimating Guide, Volume 6* (available at http://www.fm.doe.gov/fm-20/costest.htm) indicates that Engineering, Design and Inspection (EDI) costs for DOE-related construction projects have generally been between 15% and 26% of the total construction cost. The EDI cost for the vitrification technologies was recently reduced by FDF to $16,858,912, which is still 43% of the total capital cost estimate. Further explanation is requested indicating why the EDI cost would be expected to be significantly greater than those historically observed within the DOE complex.

14. The response to a previous comment made by this author concerning the development of the Engineering, Design and Inspection (EDI) costs for construction indicated that the Full Time Equivalent Method was utilized for its estimation. As such, one primary driver in estimating the EDI costs is the assumed time periods for the various design phases. These time periods are exactly the same for the cyclone vitrification and the cementation technologies. The only difference is a slightly lower number of professional staff for the two cementation technologies.

The EDI cost in general depends upon the amount of new engineering required and the complexity of the project. DOE and the commercial sector have had significant experience with cementation (even cementation of uranium-bearing soils and UMTRA waste). The two non-vitrification technologies are much less complex and are not high-temperature, high-energetic processes like the two vitrification technologies. It would therefore appear intuitive that the level of EDI support for the more-established cementation technology would be (much) less than that for the not as technically mature cyclone vitrification technology. However, this expected difference in EDI cost is not shown in the four cost estimates.

Are the estimated time periods and staffing levels proposed for the estimated EDI costs similar to those collected in fulfillment of the reporting associated with DOE Order 2200.6? If possible, please provide the basis within the text for the time periods applied for the various EDI phases.

14. An assumption that has important cost implications is the technology contractor-supplied design based upon a 70% availability factor. The facility design for remediation of the Silos 1&2 residues requires an annual availability of 70%, which may result in more than one production train given a low reliability of a given technology. What information has been gathered by FDF concerning the annual availability (other than the POP tests) of the four technologies, and can this data (if available) be included within the cost estimate? Does FDF's review of historical experience with these technologies support an annual availability of 70%? If not, what changes would be implemented within the design and associated cost estimate to achieve this factor?

15. Comparison of the costs between the four technology options indicates no major difference in the risk budget percentage between the technologies. This is not intuitive. Factors that affect the estimated risk budget percentage include equipment complexity, the use of an innovative technology, required reliability, and technical maturity. Consideration of these factors would indicate that the cementation technology (which is not complex, fairly robust, and technically mature) should have a risk budget markedly different than that for joule-heated vitrification (which is complex, requires periodic replacement of key equipment components, and can be considered to be an innovative technology).

An example where the technical maturity and process complexity was considered in the development of the risk budget (also known as cost uncertainty) can be found in Section K.2.6 of the document *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement, Volume Two* (DOE/EIS-0189, August 1996). In this document, the proposed application of an alternative with many first-of-a-kind technologies with a high degree of complexity resulted in the highest upper cost range.

It may be advisable for FDF to reconsider the factors used in the development of the risk budget percentages for the four technologies. A value of 15% may be appropriate for the cementation technology. However, a much higher value (up to 55%) may be considered for joule-heated vitrification. It should be noted that the expected risk budget range for a feasibility study estimate of all environmental restoration activities within the DOE

000050

complex has been stated to range between 15% to 55%, based on guidance provided on page 100 of the U.S. Department of Energy's *Cost Estimating Guide, Volume 6* (available at http://www.fm.doe.gov/fm-20/costest.htm).

Review of Volume 2 of "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Vitrification Other - Combustion" Dated September 1999

1. The Section labeled "Introduction & Estimate Basis" states on the first page in the third bullet that "All other remediation activities on the site will have been completed in FY06." However, the next page indicates that the "Cost of operation of AWWT and other site support functions" have been excluded from the estimate. It would appear that remediation activities would be ongoing after FY06, namely in the form of the AWWT.

   This cost estimate assumes that site operations in the form of the AWWT and utilities (raw water conditioning, industrial waste treatment, etc.) would be available, to support the proposed remediation of the Silos 1 and 2 wastes. These support activities should also be capable of providing additional workforce, when needed, especially for maintenance. Presumably the pipe fitters and other maintenance personnel at the AWWT and other site support activities would be available, perhaps not on a full-time basis, when needed at the vitrification facility.

   It may be helpful to more fully explain in the text why the workforce associated with the other facilities at the FEMP would not be available for support of the proposed treatment facility.

2. The Section labeled "Labor Costs" in Volume 2 has a table titled "Operations and Maintenance Manpower Vitrification – Other" in which the salaries for the maintenance workforce has been misplaced one cell. As a result, the hourly salary for the Maintenance Manager is shown to be $23/hour instead of the correct value of $60/hour, etc. As a result, the annual operations and maintenance labor cost of $18,111,360 per year is incorrect and should be modified.

3. The total number of hours in the above-cited table does not agree with the multiplication of the number of hours per week multiplied by the number of weeks per year (52 total).

4. The Section labeled "Labor Costs" in Volume 2 indicates a total of 247 workers would be required to operate and maintain the full-scale cyclone vitrification facility. This number of workers appears excessive given previous experience with the Vortec vitrification system.

   As an example, Vortec currently has a 10-15-ton/d cyclone vitrification pilot unit at the Paducah Gaseous Diffusion Plant (PGDP). Full scale operation of this unit to treat mixed radioactive low-level waste has been stated to require a work force of 50 during two 10-hour shifts, based upon the document *Draft Environmental Assessment, Proposed Treatment of Mixed Waste at the Paducah Gaseous Diffusion Plant Using the Vortec Vitrification System* (DOE/EA-1230, March 1998). This appears to indicate a two-fold difference in the number of operations workers for a nearly similar throughput rate.

Examination of Appendix D (Full-scale Plant Cost Estimate) of the document *Silo 1 and Silo 2 Proof of Principle Project* (BFA-4200-809-002, April 30, 1999) submitted by Vortec Corporation to FDF indicates a much lower estimate of the operations workforce (on the order of 40 workers, similar to the actual Vortec plant at the PGDP).

One method to determine work force loading is to estimate the duration associated with individual process steps and the number of workers required to complete the task. Then the summation of the number of activities would result in a fairly accurate estimate of the number of required workers.

As such, it may be helpful to more clearly define within the text the basis by which the number of operations workers was estimated for this cost estimate. It also may be helpful to compare the number of workers estimated by FDF with actual experience with this technology.

5. In connection with the previous comment, the table indicates a total of 14 container handlers would be required. Given a total of 2,162 containers to be generated over the three years of operations and an overall availability of 70%, approximately 2.8 containers would be generated per day. This indicates that the 2.8 containers would be handled by a total of 14 workers during an average-day. Not knowing the details by which the containers are to be handled, a total of 14 workers appears excessive. What will these workers be doing while the containers are being filled? Would it be possible that these workers could be employed elsewhere within the vitrification facility during the filling time? If yes, then the number of container handlers should be decreased to reflect this.

6. The Section labeled "Labor Costs" indicates a total of 84 maintenance workers. This number of maintenance workers appears excessive, given that only 105 workers are required for operations. Assuming that the cost of plant maintenance is 5% of the capital cost (which is valid for a petroleum refinery, which is a fairly complex processing system), the total maintenance cost (which includes labor, supervision, and materials) would be on the order of $2.5 million, much less than the revised maintenance labor costs for this option.

What method was used to estimate the number of maintenance workers? Does the method take into account that the facility will be in operations at most for 4 years (and not the standard 20-to-30 years of operations assumed in most studies)?

One standard method for determination of the maintenance workforce is to determine the number of components needing regular maintenance, and then estimate the number of hours and workers required for its maintenance. As an example, *The Draft Engineering Analysis Report for the Long-Term Management of Depleted Uranium Hexafluoride* (UCRL-AR-124080, May 1997) uses a time-and-motion study approach to estimate the number of operations and maintenance workers. In this document, maintenance of an off-gas scrubber would require 2 workers for 26 hours per year; maintenance of off-gas HEPA filters would require 2 workers for 4 hours per year, etc.

It may be helpful to more fully explain within the text the rationale by which the number of maintenance workers was estimated. It also may be helpful if the number of maintenance workers estimated by FDF is compared with the components which will require ongoing maintenance during operations.

7. The first Section labeled "Material Costs" includes a table providing an efficiency/multiplier analysis to determine labor productivity. One of the factors involves the climate of the site. The footnote associated with this factor indicates that it should be considered for exterior work only. The table indicates that a factor of 70% was applied to the Climate factor, indicative of rain conditions negatively affecting labor productivity. Given that the majority of the workforce (other than vehicle operators and a limited number of maintenance workers) would be located within enclosed structures, and as such, should not be affected by rain, it is unclear why this value of 40% was applied. (A value of 100% for the Climate factor would result in a labor productivity multiplier of 1.07 versus 1.14 used in the cost estimate).

8. The Section labeled "Utility Costs" indicates a Consumables annual cost of $1,505,513 per year. Examination of Appendix D (Full-scale Plant Cost Estimate) of the document *Silo 1 and Silo 2 Proof of Principle Project* (BFA-4200-809-002, April 30, 1999) submitted by Vortec Corporation to FDF indicates an annual consumables cost of approximately $947,000 per year (excluding the cost of liquid oxygen), a 37% difference. It may be helpful to provide more detail to substantiate the FDF-estimated Consumables annual cost, including showing the annual consumption rates of consumables, their assumed unit cost, etc.

9. The Section labeled "Utility Costs" provides the annual costs of the various operations consumables and utilities. The sheet indicates a total annual cost of $8,018,555; however, summation of the individual costs results in a total of $10,730,747.

10. The above-cited table indicates that full-scale operations would annually consume approximately 14,408,925 kWh of electricity and 111,000 ccf of natural gas. Appendix D (Full-scale Plant Cost Estimate) of the document *Silo 1 and Silo 2 Proof of Principle Project* (BFA-4200-809-002, April 30, 1999) submitted by Vortec Corporation to FDF indicates an annual consumption rate of 7,257,600 kWh of electricity and 332,640 ccf of natural gas. It may be helpful to explain why this significant difference in utility consumption rates exist.

11. The above-cited table indicates a Subcontractor Support cost of $1,439,871 per year, while Appendix D (Full-scale Plant Cost Estimate) of the document *Silo 1 and Silo 2 Proof of Principle Project* (BFA-4200-809-002, April 30, 1999) submitted by Vortec Corporation to FDF indicates a weekly cost of $8,200, or approximately $426,400 for an entire year. If it can be safely assumed that the technology contractor, Vortec Corporation, is the best judge of the amount of subcontractor support during operations, it

levels of the facilities and their contents. If the latter is true, then it may be informative for FDF to refer to the document *Draft Environmental Assessment, Proposed Treatment of Mixed Waste at the Paducah Gaseous Diffusion Plant Using the Vortec Vitrification System* (DOE/EA-1230, March 1998) concerning which components of the Vortec system and ancillaries systems were assumed to be radiologically contaminated.

17. The level of effort associated with "Supervision – Contractor" on the "Estimate Summary Sheet" in the Section labeled "Remediation Facility D&D Cost Estimate" appears excessive. The following table indicates the maximum manpower that could be expected for a D&D project of this size, based on RS Means' *Environmental Remediation Estimating Methods* (1997):

Staff Type	Hours Per Week	Number of Functions	Complexity Factor	Number of Weeks	Person-Hours
Project Engineer	4	2	2	52	832
Certified Industrial Hygienist	2	2	2	52	416
Staff Engineer	40	2	2	52	8,320
Field Technician	20	2	2	52	4,160
Subtotal:					13,728
FDF Value:					17,920
Percent Different:					31%

The highest level of complexity factor was chosen in the above table (complexity factor = 2) and a D&D schedule of 52 weeks was applied, based on the D&D duration of 11.2 months shown in the cost estimate.

Even using the maximum values, the FDF-estimated Construction Management manpower is 30% greater than that calculated using the RS Means method. It should be noted that the costs of Construction Management are generally 5% to 15% of the sum of the direct costs and indirect costs (guidance from the U.S. Department of Energy's *Cost Estimating Guide, Volume 6*, p. 132, available at http://www.fm.doe.gov/fm-20/costest.htm). Further detail is requested in the text indicating how the Construction Management costs were estimated.

16. The page titled "Waste Management Costs, Top-Loading LWMB & ISO Container" indicates a unit cost of $3,452.80 per truck shipment to the NTS. This value however disagrees with the value of $4,200 per truck shipment used for the vitrified waste (a difference of 18%). It should be noted that the page indicates that "All costs are stated in FY99 dollars" so that de-escalation should not be a factor.

17. The same page indicates that a carpenter would work approximately 0.5 hours per waste container, a mechanic about 0.33 hours per container, etc. The waste management costs appear to be based upon these fractional time periods, all of which are less than one working day. However, since D&D of the facilities will be performed after "All other

remediation activities on the site will have been completed in FY06," would it not have been consistent with the approach taken for the operations and maintenance phase to assume that each staff type would be available for 8-to-10 hours per day, independent of the number of waste containers, and that the waste management labor costs would be simply the multiplication of the number of days for container preparation, packaging, etc. by the number of workers and their respective labor rate?

18. This author was only able to perform a cursory review of the "Detail Estimate Worksheets" for the D&D phase. However, I feel obliged to refer FDF to comment no. 21 referring to Volume 2 of the document "Silos 1 & 2 Waste Remediation Project Feasibility Study Estimate, Cement Stabilization." As an example, an unit manpower rate of 20 man-hours is applied for the D&D of the combustion melter and receipt system (item no. 17-pe-001), which is the same rate as applied for the EOG HEPA filter (item no. 18-fl-003). This unit rate is applied to almost all process equipment. However, the dimensions of the combustion melter in Volume 1 are stated to be 50'high by 22' wide by 22' long. It may be expected that some degree of size reduction (such as by using a torch to cut the reactor into smaller pieces that would fit in a WMB) would be necessary for the combustion melter, so that its unit D&D rate should be different from that for an easily compactible HEPA filter housing. This also would be true for other large-sized equipment that may be radioactively contaminated. It is suggested that a comparison of the unit D&D rates applied in this cost estimate with publicly-available literature values be considered.

19. The page titled "D&D Vit 1 Combustion Melter Heater" indicates that the number of WMBs was estimated based upon the bulked material volumes. However, WMBs also have a limit based upon weight, which does not seem to have been considered in the calculations. The total material weight is estimated to be 9,723 tons (19,446,000 lb.) which results in a unit weight content of about 30,900 lb. per WMB. The capacity of a WMB is on the order of 13,000 lb. (unlike a ROB's capacity of about 30,500 lb.). It may be helpful if the calculated number of WMBs takes into account its weight capacity (which may double the number of WMBs and truck shipments to NTS).

20. The costs of Project Management assume that each staff person would be 100% dedicated to the project and that these personnel would be different from those associated with plant operations, etc. It would be highly likely that the Project Management personnel would belong to a major A/E firm, so that they could be assigned to work part-time on the OU4 remediation project and part-time on other local projects. This may be very true in the case of the Project Engineering and Project Controls staff. Also, these same people may be involved in Construction Management, etc. How would revision of the assumption that each staff person would be 100% dedicated to the project affect the total Project Management cost?

21. It should be noted that the DOE's *Cost Estimating Guide, Volume 6* (available at http://www.fm.doe.gov/fm-20/costest.htm) indicates on page 132 that Project Management costs typically range from 2% to 5% of the total project cost. Excluding the

000056

costs of NTS disposal, Project Management costs are approximately 8% of the total project cost. Its percentage would be much higher if the number of workers were modified to agree with historical experience with this technology. It may be advisable to reconsider the breakdown of labor associated with Project Management.

22. The Section labeled "Waste Packaging and Shipping" contains a page titled "Detailed Estimate Worksheets." Within this page are shown costs of secondary waste packaging, transportation, and disposal at the NTS. A total transportation cost of $31,850 is shown in this table. Based upon an average cost of $4,200 per shipment from the FEMP to NTS, the transportation cost of $31,850 is equivalent to 7.6 shipments ($31,850/$4,200). It appears that either an incorrect number of shipments or unit shipping cost was used in this table.

23. In addition, no information is supplied within the text indicating the secondary waste generation rate, its characteristics (is this simply the PPE discarded by the workers after their use or does it include contaminated equipment that will be replaced during the four years of operation), etc. It may be advisable to include this level of detail within the text.

24. Finally, it may be helpful to indicate within the text the assumptions made concerning the radiation level of equipment that are projected to be replaced during the life of the project. As an example, the refractory within the various systems for the melter has a 1-year expected lifetime. Was it assumed that this refractory will be radiologically contaminated and will require proper dispositioning?

ARGONNE NATIONAL LABORATORY
9700 SOUTH CASS AVENUE, ARGONNE, ILLINOIS 60439 TELEPHONE 630/252-7475

September 9, 1999

Mr. Michael Connors
Fluor Daniel Fernald
7400 Willey Road
Hamilton, OH 45013

Subject: **Additional Review Comments for Joule-Heating and Chemical Stabilization - Other Processes**

Dear Mr. Connors:

Attached are some additional comments on the cost reports for the Joule Heating and Chemical Stabilization – Other processes. As before, we understand that these documents are still in the draft stage and that future revisions may occur. Therefore the following comments should not be taken as criticisms but only points to consider in the final document.

Please provide the comments and information given in this document to the appropriate persons. As instructed, a copy of these comments has been forwarded to Dave Yockman, DOE/FEMP. If you have any questions, please feel free to contact me at (630) 252-7475.

Sincerely,

Jerry L. Gillette
Group Leader
Cost & Engineering Analysis Group
Decision & Information Sciences Division

cc: M. Davis
S. Folga

Attachment:

000058

Additional Review Comments for Joule-Heating and Chemical Stabilization-Other Processes

1. The capital cost risk analysis for Joule heating (p. 218) has a greater number of elements than does the Chemical-Other risk analysis (p. 187). The elements for Joule heating are not defined so I couldn't determine what the differences were.

2. The consumables and utilities costs don't add to the totals shown on page 206 for Chemical-Other and page 239 for Joule heating.

3. The summary table on page 195 for Chemical-Other has different values for electrical, sub-contractor, and startup than are shown on page 206.

4. Page 226 of Joule heating appears to have some errors: Lab costs@$77,000 per year should total $269,500 for 3 ½ years; subcontractor support should be for 4 years not 3; the labor component for Health Physics doesn't agree with the backup information on page 236.

5. The O&M risk analysis for Joule heating (p. 240) doesn't include the $4,173,020 given for Supplies on page 5. There doesn't appear to be any backup for this number in the package.

6. Additional detail on the waste management costs would be helpful. For example, given the 9955 tons (dry basis) of waste in the silos, and the types of packages to be sent to NTS, I was not able to reproduce the number of packages reported in each of the packages. My first thought was that the difference represents the waste from the D&D of the waste-treatment facility itself and the remaining OU4 facilities that will support the waste-treatment process. However, the D&D cost estimates provided separately already include the disposal portion of this waste but not the costs of the disposal packages or for transportation. Since the waste cost analyses given on pages 294 for Joule heated and 267 for Chemical-Other use equal numbers of packages (2398 for Joule heated and 6106 for Chemical-Other) for the purchase price of the package, the transportation, and the disposal, it appears that there is a mis-match or an omission of some costs somewhere in the analysis. Additional detail might help to clarify these costs. I would suggest additional detail on both the silo-waste products and for the D&D of the process facility and the remaining OU4 structures.

ARGONNE NATIONAL LABORATORY
9700 SOUTH CASS AVENUE, ARGONNE, ILLINOIS 60439   TELEPHONE 630/252-7475

September 7, 1999October 12, 1999

Mr. Michael Connors
Fluor Daniel Fernald
7400 Willey Road
Hamilton, OH 45013

Subject: **Review Comments for Joule-Heating and Chemical Stabilization-Other Processes**

Dear Mr. Connors:

Attached are some additional comments on the cost reports for the Joule Heating and Chemical Stabilization – Other processes. As before, we understand that these documents are still in the draft stage and that future revisions may occur. Therefore the following comments should not be taken as criticisms but only points to consider in the final document.

Please provide the comments and information given in this document to the appropriate persons. As instructed, a copy of these comments has been forwarded to Dave Yockman, DOE/FEMP. If you have any questions, please feel free to contact me at (630) 252-7475.

Sincerely,

Jerry L. Gillette
Group Leader
Cost & Engineering Analysis Group
Decision & Information Sciences Division

cc: M. Davis
S. Folga

Attachment:

000060

Review Comments for Joule-Heating and Chemical Stabilization-Other Processes

1). There are frequent inconsistencies in the numbers presented in the various tables. For example, several values given in the Control Estimate Summary do not agree with those produced in the backup material.

2). The Start-up Testing costs should be based on a six month long period but the values appear to be for a full year.

3). Mobilization costs include a $60,000 relocation allowance for each of 10 people. This appears to be a bit excessive.

4). Subcontractor Oversight costs are noted as lasting for 1 year. Some detail is provided for the Joule-heated Vitrification case that suggests that it be for the three-year period of operation. Additional questions on this issue: Wouldn't this oversight be more reasonably assumed to also include the startup testing and prototype testing (as needed) and thus last for 3 1/2 or 4 years? The values are also a bit puzzling with about $1.4 million for the two heating methods, $2.2 million for cementation, and $2.3 million for chemical stabilization. That is, the two most sophisticated technologies have the lowest oversight costs.

5). Some of the pages were edited incorrectly. For example, page 9 of the Chemical Stabilization reports refers to the joule-heated process.

6). The Contractor Supervision costs are estimated at 17% of the direct field labor costs. However, when estimating the man-hours associated with this cost, a rate of $21.96/hour (the average of all field labor costs) was used. While this may not be a cost issue, it might be a scheduling issue, as I would expect the supervision rate to be significantly greater than the average field labor cost.

7). Engineering/design/inspection costs are based on 253 weeks of time (not effort weeks) for the Cementation and Chemical Stabilization technologies and 273 weeks for the vitrification technologies. The associated costs are very high percentages of the direct capital costs, e.g., 75-82% for the vitrification cases and more than 100% for the other two cases.

8). It is not clear where the numbers used in the risk analysis came from. For example, for chemical stabilization the Civil & Excav, labor cost is listed as $416,143 whereas the direct summary says $203,793. Allowing for markups on this number I can get it to $403,143 but it is still $13,000 off. Also, the material costs in the risk table is given as $79,850 whereas the direct summary gives it as $100,850.

9). The O&M labor costs appear to be low for all inclusive values. For example, the cost for the Plant Manager is $60/hr. The costs seem to be based on a 48 week year. For joule heating, there is an error in that the Maintenance Manager's salary is not included in the total.

10). I could not reconcile the number of people needing physicals with the number of people who will be working in radiation areas.

11). The schedule given in calculating the cost of money is puzzling There appears to be a two year hiatus where nothing happens. The actual operations appear to last for two years rather than the design basis three. Some of the numbers can not be reconciled with data elsewhere in the reports. At the end of FY10, the government will still over $14.6 million (for chemical stabilization) with more than $1 million of this in interest accrued during FY10. Thus I don't think the total cost of money calculation goes far enough.

000062